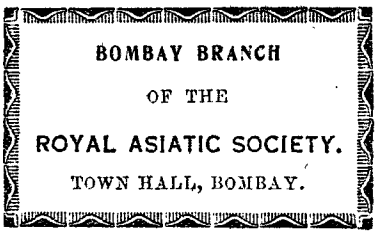
00083415



Digitized with financial assistance from
Hermès India
a project facilitated by the Rotary Club of Bombay
on 10 August, 2018

Photo by Stearn & Sons, Cambridge.]

SLEDGE-MATES AT CAMBRIDGE, NOVEMBER, 1913.

(*Standing*) Debenham and Wright of Caius; (*sitting*) Taylor of Emmanuel and Priestley of Christ's.

WITH SCOTT:

THE SILVER LINING

BY

GRIFFITH TAYLOR, D.Sc., ETC.

83415

WITH NEARLY 200 ILLUSTRATIONS AND MAPS

LONDON
SMITH, ELDER & CO., 15, WATERLOO PLACE
1916

All rights reserved

910 115c 777
Tay/wit
83415

PRINTED BY
WILLIAM CLOWES AND SONS, LIMITED
LONDON AND BECCLES

INTRODUCTION

THE great adventure of Scott's last expedition has been given to the world in the faithful simplicity of the leader's own words, as they were set down from day to day. His diaries were but the basis of the book that should have been written. We have not the half of what he could have told us. But in another sense, that half is greater than the whole. Here stand first impressions, not retouched: the ebb and flow of his hopes and fears, the lights and shadows of the moment, never reviewed in later perspective after the event; thumb-nail sketches of character, vividly set down; notes of the day which reveal his spirit entering into the spirit of his men: and at the end, the singleness of heart that could give all and accept all for one high purpose. I have often liked to think—surely it is true—that the universal thrill awakened by his example strung up the soul of the nation unawares for the great call so soon to be made upon it.

The other half of the picture has been partly filled in. Others have given the history of outlying explorations with their tale of human resource and endurance; they have recorded scientific results or described special branches of natural history in the Antarctic. Something, however, is still left to be told. No one will forget Captain Scott's almost incredulous delight at the goodwill and harmony of his little company under the trying conditions of Ross Island. It is for Mr. Griffith Taylor to tell of the daily life of that company from within, to tell in careless detail its lighthearted cheerfulness lining solid effort, which the cloud of English earnestness so constantly turns out upon the night.

The "other side of the shield" is too often a byword for irreconcilable contradictions. It is not so here. The reader

is doubly grateful. He is grateful for the details of the daily round as it passed in the explorers' hut; he is grateful for the sense that new testimony only bears out former report.

Nor are these personal impressions all, though they extend over a longer period than that covered in the "Last Expedition." Mr. Griffith Taylor also gathers up what has in large measure appeared elsewhere, the story of his own explorations and much of his general scientific results in geology and physiography, so that his Antarctic experiences stand together as a union in thought and action of all that is typified by the old name and the new, Cambridge and Melbourne, each his Alma Mater.

The book makes its appearance in the midst of a great war, when books are too often regarded as a first luxury to be cut off. Nevertheless I hope that many will be able to find in its pages some refreshment of mind, some relaxation from the long strain, some strengthening of faith in the latent spirit of the Greater England which has sent its sons from the four quarters of the world to stand beside the Old Country in the hour of destiny.

LEONARD HUXLEY.

February, 1916.

CONTENTS

I

PAGE

GETTING TO KNOW THE MEN 1

II

THE *TERRA NOVA* GOES SOUTH 19

i. The Geologists visit the New Zealand Glaciers . . . 21

ii. Ship Life in Calm and Storm 30

iii. Learning the Ropes 45

iv. Blocked by the Pack Ice 56

v. Through the Ross Sea 79

vi. Making Winter Quarters at Cape Evans 87

III

FIRST WESTERN EXPEDITION, JANUARY–MARCH, 1911 . . . 113

IV

A MONTH IN THE OLD *DISCOVERY* HUT, MARCH–APRIL, 1911 . 187

V

IN WINTER QUARTERS WITH CAPTAIN SCOTT, APRIL–NOVEMBER, 1911 211

VI

GRANITE HARBOUR EXPEDITION 329

VII

THE VOYAGE BACK, FEBRUARY–MARCH, 1912 413

VIII

THE END OF THE EXPEDITION 437

APPENDIX 449

INDEX 456

LIST OF ILLUSTRATIONS

FULL PAGE PLATES

FACING PAGE

Sledge-mates at Cambridge . . . . . *Frontispiece*
Officers and Crew, Captain Scott's Antarctic Expedition, 1910 . . 16
Icing Ship in the Pack on the Starboard Quarter 61
The Norwegian Dinghy or Pram retrieving Birds in the Pack Ice . 61
A Quiet Sunday Evening on the *Terra Nova* 65
D. Lillie, Ship's Biologist 66
The Northern Fringe of the Pack Ice showing the Wake of the Ship through Open Pack 66
Catching the Fish in the Pack 70
Surveying the North Coast of Ross Island from the *Terra Nova* . . 88
Photo from the Ship of Cape Evans 88
The First Hour Ashore 92
Two Motor Sledges on the Beach at Cape Evans 92
Photo of the Hut showing the Ramp and Erebus 106
Penguin Courtship on the Ice-foot near Cape Evans . . . 106
Ship aground on a Reef off Cape Evans close to the Tunnel Berg . 108
Griffith Taylor in Summer Rig (on a keen day) on Cape Evans . . 108
Model of Country traversed on First Journey 118
My First Camp in Antarctica at the Snout of the Ferrar Glacier . 126
Photo taken just before we packed the Sledges for the First Sledge Journey 126
Trying Times on the Koettlitz Glacier 163
Tables of Ice "Mesas" in the Lower Koettlitz cut out of Thaw-water 163
Alph River cutting through the Moraines and Ancient Ice . . 189
Discovery Hut 189
Crater Heights, the Gap and Observation Hill as viewed from the Old *Discovery* Hut 196
Mount Erebus from the Old *Discovery* Hut 196

FACING PAGE

Bowers' Party adrift on the Sea-ice 198
Over the Hutton Cliffs to test the Sea-ice 207
Captain Scott wearing the Wallet in which he carried his Sledging Journals 214
Simpson sending up a "Ballon Sonde" 218
The East Corner of the Hut showing the Eddy Trench scooped out by Blizzards on the Windward Side of the Hut 218
Captain Scott's Autograph List for the Aurora Watch 226
Some Antarctic Archives 266
Snowdrift on Cape Evans, showing the Deep Eddy on the Windward Side 275
Debris Cones on Land's End (one mile south of the Hut) . . 275
"Blizzometer Record" during the Search for Atkinson . . . 277
Lakelets of Cape Evans 296
A fine Steam Cloud blowing South from Erebus 307
A Glacieret near Island Lake (C. Evans) due to Wind-blown Snow . 307
Ice-quakes in the Sea-ice 310
The Tide-crack at the North-west Corner of Cape Evans . . . 310
High Cliff and the South End of the Barne Glacier 312
"The Barrier Silence" 313
Bernard Day on the Motor Sledge just before he started for the South 322
The Start of the Motor Sledges 322
Wilson packing his Pony Sledge the Day before the Start for the Pole . 328
The Hut after the Winter 328
Relief Model of the Region traversed in the Second Summer . . 331
The Second Western Party the Day they were picked up by the Ship . 332
A Panorama of Cape Roberts, where the Western Party was isolated for Three Weeks. Looking North 350
Avalanche Cliffs on the South Side of Granite Harbour . . . 350
The Field of Crevasses (Skauk) at the Foot of Mackay Tongue . . 353
Granite Hut, Cape Geology 360
Forde cooking Seal-fry on the Blubber-stove at Cape Roberts . . 360
Heavy Sledging off Mackay Tongue just where we tried to pack to Land 365
The "Half-Ton" after Nelson left us off the Mouth of Dry Valley . 365
A Tight Corner! Crossing the Forty-foot Tide-crack off Point Disappointment, Granite Harbour 367
The First Western Party in a Natural Ice-tunnel amid the Pinnacles of the Koettlitz Glacier 380
The Second Western Party at Cape Geology, Granite Harbour, on Christmas Day, 1911 380

FACING PAGE

Gran's Midsummer Bath 392
The Couloirs of Mount England (which develop into Cwms later) . 392
The Rush to Safety : over the Edge of the Blue Glacier . . . 411
Engineer Williams at the Winch 418
Bernard Day on the Capstan 418
A. B. Cheetham, who holds the Record for crossing the Antarctic Circle 426
G. C. Simpson 426
A very "Ordinary Seaman" 428
Pennell on Bridge 428
Photo of Crew off Akaroa 435

ILLUSTRATIONS IN THE TEXT

PAGE

Block Diagrams illustrating the Basins, Gorges, and Riegel in the Val Ticino below Saint Gothard 9
Section across Poop of *Terra Nova* 22
Harbours visited on the Voyage to New Zealand 24
The Cuspate Peaks of Mount Cook and the Matterhorn . . . 25
The Snout of the Tasman Glacier from Sebastopol 26
Glaciers in New Zealand visited in November, 1910, by the Geologists 27
Looking down the Snout of the Mueller Glacier from the Stocking . 28
Plan of the Deck of *Terra Nova* 39
Vertical Section of *Terra Nova* illustrating Incidents in the Great Storm, January 2–3, 1911 42
Figures of Latitude and Longitude 51
Iceberg Forms 64
Sounding Apparatus 67
Course of *Terra Nova* through the Antarctic Pack as far as Cape Evans, Dec. 7, 1910–Jan. 4, 1911 77
Coasting Ross Island, Jan., 1911 81
Life's Round in the Antarctic 84
Cape Evans from Inaccessible Island 90
Sun-holes 93
Antarctic Spoor 94
Iceberg Equilibrium. The Tilting of the Tunnel Berg during the Winter, 1911 97

PAGE
Sketch of Two Grottoes cut in Glacieret near the Hut, Jan. 15, 1911. 102
Sketch Map of Cape Evans, Jan. 21, 1911 107
Geological Sketch by Captain Scott 114
Facsimile (reduced) of Captain Scott's Sledge Instructions . 122, 123
Geological "Sandwich" near the Dun and Hedley Glaciers . . 131
Moraine Material at the Taylor Glacier, looking West . . . 135
Crater on the Flank of the Taylor Valley 137
The Avalanche-fed Lacroix Glacier in the Taylor Valley . . . 140
Sketch Section across the Taylor Valley at Suess Glacier, showing the Nussbaum Riegel which bars it 141
Looking west up the Dry Valley below Taylor Glacier . . . 142
"The Compleat Explorer" 144
"Anarthoclase" Felspar 145
The Age of Rocks above the Taylor Glacier 147
Plan of the bygone *Twin* Glaciers of Lake Luzern 149
The Morphology of Frozen Ski-boots 154
"My Footgear" 159
Empty Hanging Valley on the North Wall of the Davis Glacier . 161
"How Evans won his Bet" 163
The "Palimpsest" theory. Generalised Sketch Sections showing the chief types of Valley Erosion 175
Forks for Blubber 176
Map showing our Journey round the Breaking Barrier . . . 178
Sketch Map of the Environs of Hut Point 190
Plan of the rejuvenated *Discovery* Hut 191
The Blubber Stove in the Old *Discovery* Hut 193
Steig-eisen 197
The Sackcloth Helmet 200
Blubber-Lamp made from Tin Matchbox 201
Testing the Sea Ice off Castle Rock 205
From Castle Rock to Cape Evans 206
The Two Tents on the Ice-shelf at Little Razorback Isle . . . 208
Plan of Hut, 1911, showing Nicknames and Bunks of Explorers . 212
The Electrical Breadmaker 216
Changes in Wind Direction 217
Simpson's Clue 218
Simpson's Instruments 221
The Arch Berg before it fell in and became the Castle Berg . . 227
Balloon Meteorograph 234

PAGE
Evans teaches us to Cobble 253
Temperature Curves 255
Sections of Fossils, Beardmore Glacier 255
Fossil "Sponge-Coral" from the Beardmore Glacier . . . 256
Archeocyathinac Marble set in a Ring 257
Bill's Nose-nip 262
A Characteristic Portrait in a Bliz ! 263
Vertical Temperature Gradient in Hut 263
How we found Midwinter 269
The Night Watch Supper 274
Lost in the Blizzard 276
The Twin Glaciers 280
The Future Ice-age 281
Reversal of the Steam Banner of Erebus 281
The Mouse-trap Camera 289
The Wind-ridge on Inaccessible Isle with Tracks 294
The Dissected Debris Cone 297
A Peculiar Animal seated on the top of a Debris Cone . . . 298
Book-plate illustrating Polar Clothing 301
Robinson Anemometer 306
Sunshine Recorder 306
"Taylor's Patent Heel-tips" 308
The Waved Edge of Glacier Tongue 316
The Seal's Method of rasping away the Ice 317
"Polar Wireless" 318
Ice Crampons 323
Our Water Supply—The Granite Pool at Cape Geology . . . 354
Gomphocephalus, Antarctic "Springtail" 356
Pressure-ridges in the Sea-ice looking West from Cape Geology to the Punch Bowl Cwm 361
Pulpit Rock, the home of the Sea-kale 370
Ironclad Boots for Antarctic Geologists 373
Looking North-west from Cape Geology, showing the Granite Cliffs of the Kar Plateau capped by dolorite 374
Gran's Bête Noire 375
Sketch Map of Region near the Devil's Punch Bowl . . . 376
Mount Suess Nunatak looking West from Redcliff 383
Sketch Map of Mount Suess Nunatak and Gondola Nunakol . . 385
"Erratic" perched on Six Small Stones, Gondola Ridge . . . 387

ROYAL

PAGE

Sketch-diagram of South-west Face of Mount Suess, showing the Fossil-bearing Beacon Sandstones 389
Gondola Ridge from the top of Mount Suess looking North-east . 391
Sea-kale at 77° 393
Flexure in 30-feet Berg, Cape Roberts 403
Diagram illustrating the Way we managed to "Raise Anchor" by "Luff upon Luff" 420
Method of fixing Ice Anchor 421
Trimming Coal in the Starboard Main Hold 425
Chart of Bay of Whales 432
Chart of Parties (Amundsen reaches the Pole) 439
Chart of Parties (Scott reaches the Pole) 441
Chart of Parties (the Last Camp) 442
Clossopteris 444

MAPS

PAGE

1. The Chief Travels of the Sixteen Officers at Headquarters, Cape Evans, 1911 12
2. Map of Antarctica showing Localities of Recent Expeditions . . 37
3. Map of the Coast from Cape Royds to Hut Point . *Facing* 86
4. Physiographic Features of Cape Evans due largely to the Retreat of the Erebus Glacier 299
5. Return Voyage of the *Terra Nova* in March, 1912 414
6. Recent and Future Exploration 450
7. Map of the Region traversed on the Western Journeys, 1911–1912 *At end of text*

I

"GETTING TO KNOW THE MEN"

"GETTING TO KNOW THE MEN"

"WHERE can I find Dr. Wilson?"

I had just entered the quadrangle of the Biological Schools at Cambridge, when a door opened quickly, and a well-knit, wiry individual ran down the steps towards me.

"Which Dr. Wilson?" said he.

"Wilson of Antarctica," I replied.

With a quizzical smile that I was soon to know well, he returned, "I am Dr. Wilson."

It was in this way that I made the acquaintance of the Scientific Director of the expedition; and in the ensuing conversation at Christ's College I learnt the requirements of Captain Scott. But the steps leading to this Sunday interview were rather amusing to look back on.

On a Saturday afternoon of December, 1909, I had been having tea with Wright of Caius, and we discussed many topics, such as cancer and Canada, eugenics and Shackleton. He remarked that he would like to go with Scott next August, and that he would go if I would! However, we did not discuss this topic, for I left to dress for the Philosophical Society's Dinner at John's. In the old Combination room were most of the scientific dons, and Dr. Marr beckoned to me.

"I wanted to see you. Would you like to go with Scott to the Antarctic as English geologist?" He was pleased to say that my glacial work and travels suited me for the post. I said I had not thought of it at all. He added that Dr. Wilson would probably call on me on Sunday, to which I replied that I had intended to be off to the Alps at 9.30!

I departed, only to fall into Professor Seward's hands. He asked the same question; and Hutchinson of Pembroke came up a moment later and said, "Don't you think Taylor ought to go to the Antarctic?" I suggested that I felt as if I were being pushed out into the cold!

I postponed my trip to Grenoble for half a day, and had a long talk with Wilson. He gave me a letter to Captain Scott, which I presented after my return from France.

We had a fine trip! Four Australians cycling through the High Alps in mid-winter. When it did not snow it rained—and mostly it did not snow! At the pass of Croix Haute we had to traverse thirty kilometres of heavy snow, and later in the Auvergne we found that snow formed quite a good surface for a bicycle, which discovery nearly led to a fatality in the Antarctic, as will appear later.

On my return to London a month later (8th January) I called at the Antarctic offices and had an interview with Captain Scott.

I soon gained an insight into the multifarious occupations of a Polar commander. The offices of the expedition were in Westminster, at 36, Victoria Street, halfway between the Abbey and the vast railway station at Victoria. They were situated in a district peculiarly devoted to the empire's interests, for most of the colonies have their representatives there; and that greatest boon to travellers, the Army and Navy Stores, is just across the way.

I will try to give some idea of the appearance of the expedition's headquarters during the busy months of preparation. In a large room occasionally sat Captain Scott, but he was usually busy with some ingenious foodstuffs or patent appliance in one of the other rooms. Adjacent was the secretary's office, and there he was to be seen, *inter alia*, wading through some of the eight thousand applications from eager souls anxious to get out of the rut by joining the expedition in one capacity or another. Naturally enough, the names of naval officers were numerous, both on the staff and among those applying. In fact, the navy could beat any other team that the expedition could get together at any game whatsoever. An explorer friend of mine had no great opinion of navy men, and strongly advised me to learn boxing to uphold the dignity of science. So I started a boxing club at Cambridge among the scientists, but we did not know then that navy champions like Parny Rennick and Dr. Atkinson were to join the expedition. Here let me add that arrogance was the last attribute of my dear naval friends down South.

In a third room at headquarters were samples of patent

foods. One open tin discloses shrivelled root-like objects about the size of lead-pencils. This was desiccated rhubarb, and it seemed merely concentrated sourness in its present state, though it furnished many dishes at headquarters later on. Cabbages and greens too much resembled coarse leaf tobacco to be eulogized by a non-smoker. A Cambridge friend —doing physiological research—was extremely pleased when he heard I was going South. "Ah," said he, "you can try my patent food all next week; you'll need nothing else for any of your meals, and I can give you a full supply for the Antarctic." Owing to various contingencies, the tin remained unopened, and I left it, with my blessing, for the landlady.

In another corner of the same room an eager inventor is explaining the excellences of his patent stove, which burns almost without fuel and is guaranteed "to produce little or no carbon dioxide"!

Here I first saw Dr. Simpson, who was wrestling with this invention, which—apart from its chemical peculiarities—seemed suitable for warming his magnetic hut. The equipment of this mansion seemed to occupy all his waking thoughts, while his chief exercise seemed to be taken by whirling sling thermometers.

The other room was almost filled with a huge petty officer who was sorting gear for the sledges. I looked at his sturdy proportions with considerable respect, which would have been increased had I known how invaluable "Taff" Evans was to be on my first expedition in the Antarctic. An old 1902 sledge was lying in the passage, whose splintered runners and weather-worn appearance told graphically of the screw-pack and "bottle-glass" ice it had surmounted in the past.

Captain Scott was busy at first, but I soon had a long talk with him. In my journal I wrote as follows:—

"Scott is just what I expected, a sturdily built, clean-shaved naval officer, with plenty of humour and decision. He told me that Mawson was coming over from Australia immediately. His idea was to have two geologists on the Erebus side of the Barrier, and one on King Edward VII. land. The latter party would have wireless if possible. He drew a moving picture of me wiring signals of wind velocity, etc., to Mawson. 'Just like old times, a friend at each end,' said he. Scott is going to try for the Pole along the old route, I gather, and

not *viâ* King Edward VII. land. The ship will leave in July and make a long trip *viâ* Madeira and Kerguelen to enable the men to shake together."

Lieutenant Campbell was often in and out of the offices. His was an independent command, and he was collecting his stores and labelling them with a distinctive broad green band. The cases were made of Venesta—a patent three-ply material, extremely light and extraordinarily tough. One could hardly break into them with a pick-axe! They were bound with iron and made to contain about 40 lbs. weight, to facilitate handling.

The question of Antarctic clothing greatly interested many ladies of my acquaintance. Some of them, indeed, were so urgent that I should look into this matter, that I began to get alarmed myself. On inquiry I found that the fur boots were carefully arranged to go over four pairs of socks and a layer of senna-grass; which seemed to point to a somewhat wide margin of safety. Of the Antarctic suits—trousers, jerseys, and overalls—I was told there was a supply in two sizes—long and short! I looked at the scientific director as he smilingly gave me this information, and judged what would fit him would suit me, so that no measurement was necessary in this class of tailoring.

The first order from Captain Scott concerned the purchase of clothing for the voyage to New Zealand. For this £8 was allowed by the Expedition. I told Captain Scott that I was not making the voyage in the *Terra Nova*, and had a kit of tropical gear already. He remarked with a twinkle in his eye, "Never mind about that, I dare say you will be able to spend it on something useful!"

A few days later I went to the West India Dock and saw the *Terra Nova* for the first time. Here was Lieutenant Evans "merry and bright" from the start! He was assisting Captain Scott to chalk out cabin spaces on the deck. In a later section I describe her equipment very fully, so that there is no need to dwell on it here, save that amongst the large liners in the dock she had somewhat the appearance of a minnow among the Tritons. At any rate, the "leviathan" is half as large again as Shackleton's *Nimrod*, and if Columbus could board her no doubt he would feel himself on a Lusitania.

About this time I received a cable offering me a post on the Commonwealth staff. Through the kindness of the authorities concerned I was able to hold both positions concurrently ; and I went South with a definite commission to study all the scientific factors—but especially the meteorology—which might concern Australian interests.

Early in February Mawson came up to Cambridge to stay a few days with me. We had passed through Sydney University together, and done our early geological field work under Professor David. We had kept in touch with each other and had many common friends. During my cycle trip through the Alps, Glasson (from Adelaide) told me that when any of Mawson's acquaintance at Adelaide University wanted chocolate, the explorer would take an ice-axe and break a lump off the huge block he had looted from Shackleton's Expedition ! I felt that an expedition of this type had peculiar attractions for me, but, alas ! our chocolate supply was never on such a prodigal scale.

Mawson gave us a talk at the Research Students' Club that evening. He told us many harrowing tales, and glances of pity were bestowed on Wright and myself by the other members of the club ! The next afternoon he was persuaded to give a lecture in the geological school, so that we knew a lot more of Antarctic conditions before he left. By this time he had decided not to accept Scott's offer of a position on the staff, but he gave all of us much useful information as to equipment and research.

Two other Cambridge men—both biologists—were appointed to the staff. I had heard of Lillie's adventures in the Atlantic, where he had carried out anatomical dissections with an axe ! His subjects were whales, on which, I take it, ordinary instruments would have had but little effect.

He was a John's man, while Nelson came from Christ's. Nelson had been "down" for some time, working at the Plymouth biological laboratory. I had heard of him from a friend of mine who had worked there also.

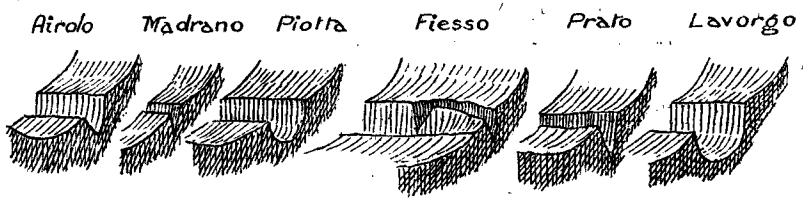
Wright, of Caius, had been a mate of mine for several terms. He was a leading light in our Peripatetic Club, and was in fact the best walker among the members. Wright and I heard so much of the prowess of the naval men in every branch of athletics that we decided to show them that the scientists had

some muscle. One morning we set off from Cambridge at 5 a.m. with some boiled eggs and chocolate and walked to London, where we reached St. Paul's, Islington, at 5 p.m. It was a non-stop effort, and Wright came through "smiling," but my feet were so sore that I could hardly stand next day. My chief recollection is one of loathing for hard-boiled eggs, and of the relief with which I dropped three-quarters of our provisions in a secluded corner of King's Cross!

During the Easter vacation I planned a trip to the Engadine and Como to study glacial erosion in some detail. I had already spent some months in this part of the Alps, and wished to gain fresh data on many questions. A college friend accompanied me. Professor Bonney was kind enough to give us advice as to the best routes during March, for my previous trips had been in summer. He also discussed the questions of valley erosion at some length, and I was glad to hear that they would form the basis for his presidential address to the British Association at Sheffield. He was strongly opposed to W. M. Davis' views on the subject, holding that *water* and not *ice* had cut out most of the Alpine valleys. I had learnt my glaciology from the eminent American while in the Swiss Alps, and was naturally Davisian in consequence. However, Antarctica led me to place more stress on *frost* action as an eroding agent, so that my position is now between the two schools!

We had an interesting and useful trip lasting for six weeks. This is hardly the place to discuss the results of this journey, though in some sense it belongs to the Expedition, for Captain Scott paid the bulk of my expenses. I visited for a second time the wonderful valleys north of Bellinzona, the Val Mesocco to the north-east and the Val Ticino to the north-west. At Mesocco and Faido are two of the most striking bars or "riegel" across the Alpine troughs, and later in Antarctica I was to find a third even more striking example. Thus, about twenty miles south of Saint Gothard is the *basin* of Piotta, a trough with vertical walls two thousand feet high and a flat valley floor. This is analogous to the Antarctic valley containing Lake Bonney (77° 30' S.). Then at Fiesso this basin is bounded by a great bar or *riegel*, through which a narrow defile passes at one side; so also at the Nussbaum Riegel in Antarctica.

Below Fiesso is the broad *trough* of Lavorgo closely paralleled by the broad "dry valley" in the southern continent.



Block diagrams illustrating the basins, gorges, and riegel in the Val Ticino below Saint Gothard. (Cf. Taylor Valley, Antarctica.)

On my way back from Italy I stopped for a few days with the glaciologist Nussbaum at Bern, and explored the queer drainage in the valleys near that city. In the last Ice Age all this fertile country lay below the Rhone Glacier, and I was to find that many of the features in Antarctica reproduced, in the present, the past history of the Swiss scenery.

I reached London on the evening that Peary gave his lecture in the Albert Hall. Mawson had given me his ticket and I decided to go, though I had to appear in my touring rig of puttees and peletin. I heard that Bernard Day—our motor expert and lately with Shackleton—had the next seat. It was a tremendous crowd and a very interesting lecture. As is somewhat usual with Americans, he gesticulates more than is common among British speakers. He had just received the medal (which was designed by Lady Scott) and expressed his sense of the honour done him and the care with which he would cherish this token of the Geographical Society's esteem, when the medal dropped violently from his hand amid audible amusement from the thousands comprising his audience. However, he picked it up and proceeded with his remarks with the greatest *sang froid*. Day and I were much impressed by his method of relaying with dog teams, and felt that he deserved full credit for his long-sustained attack on the North Pole. Three years later I was to be again in the Albert Hall to hear Commander Evans describe the British conquest of the Pole; but Bernard Day had now settled "on the land" near my own home in Sydney, New South Wales.

Before I left England I had met most of the officers. Bowers I first saw at dinner one evening with Captain Scott.

Lady Scott was coming out to Australia, and was much interested in the political and social questions of the "British continent." She had done some long tramps in Switzerland, and told us much about the Fabian Society and about her art life. She had heard of our tramp to London. "Did you really walk sixty miles in ten hours?" So had rumour reported it. It was mortifying to confess to a bare fifty miles in twelve hours! Birdie Bowers appeared in the full insignia of a Lieutenant of the Indian Marine. He was at this time so busy loading the ship at the docks that I did not see him again until I joined the *Terra Nova* in New Zealand.

On the 12th of May I joined the *Orontes* and I reached Melbourne at the end of June. For the next three months I was busy at the new Federal capital—then unnamed,—where I carried out various surveys for the Commonwealth.

In July Professor David sent me some microscope slides made from a limestone obtained by Shackleton's party on the Beardmore Glacier. To our delight I was able to identify them as fossil "corals" of Cambrian age, of the same genus as those from South Australia on which I had been working at Cambridge. Some account of these Antarctic fossils which Wright also discovered in some of his specimens from the Beardmore is given in the account of our life at headquarters.

Professor David gave me invaluable advice on Antarctic matters. At the School of Geology at the University of Sydney is a large "Antarctic Room" filled with specimens collected on the 1907 Expedition. Here Priestley had been working out results for many months, and here he presided over informal "tea" at 4.30 every afternoon! Here I met Alan Thomson, a geological scholar from Oxford, who was to have been one of us, but that he developed lung trouble at the last moment. In consequence of Thomson's illness, Priestley obtained Shackleton's permission by cable, and thereupon accepted Captain Scott's offer to join us. Many were the yarns Priestley told us of his 1908 experiences. He said that the young Eskimo dogs, born down there, never knew water, yet they held out a water-can for a drink when they saw it! More credible was the story of how they buried the water-can (containing a future drink) and were profoundly disgusted on digging it up to find that their refreshment had vanished! The yarn which I fear I completely disbelieved—

anent killing skua gulls by throwing a slab of rock vertically upward—I proved practically a few days after landing at Cape Evans, as will appear in its own place.

Meanwhile the *Terra Nova* had left Cardiff and slowly sailed by the "wind-jammers'" route to New Zealand. They had an exciting time at South Trinidad—a lonely island off Brazil—swimming through shark-infested surf to the shore. Here they made some biological collections, and on the remainder of the voyage many of the land-lubbers became respectable sailor-men. I hardly knew Wright when I saw him reefing sails and running up the ratlines as if to the manner born.

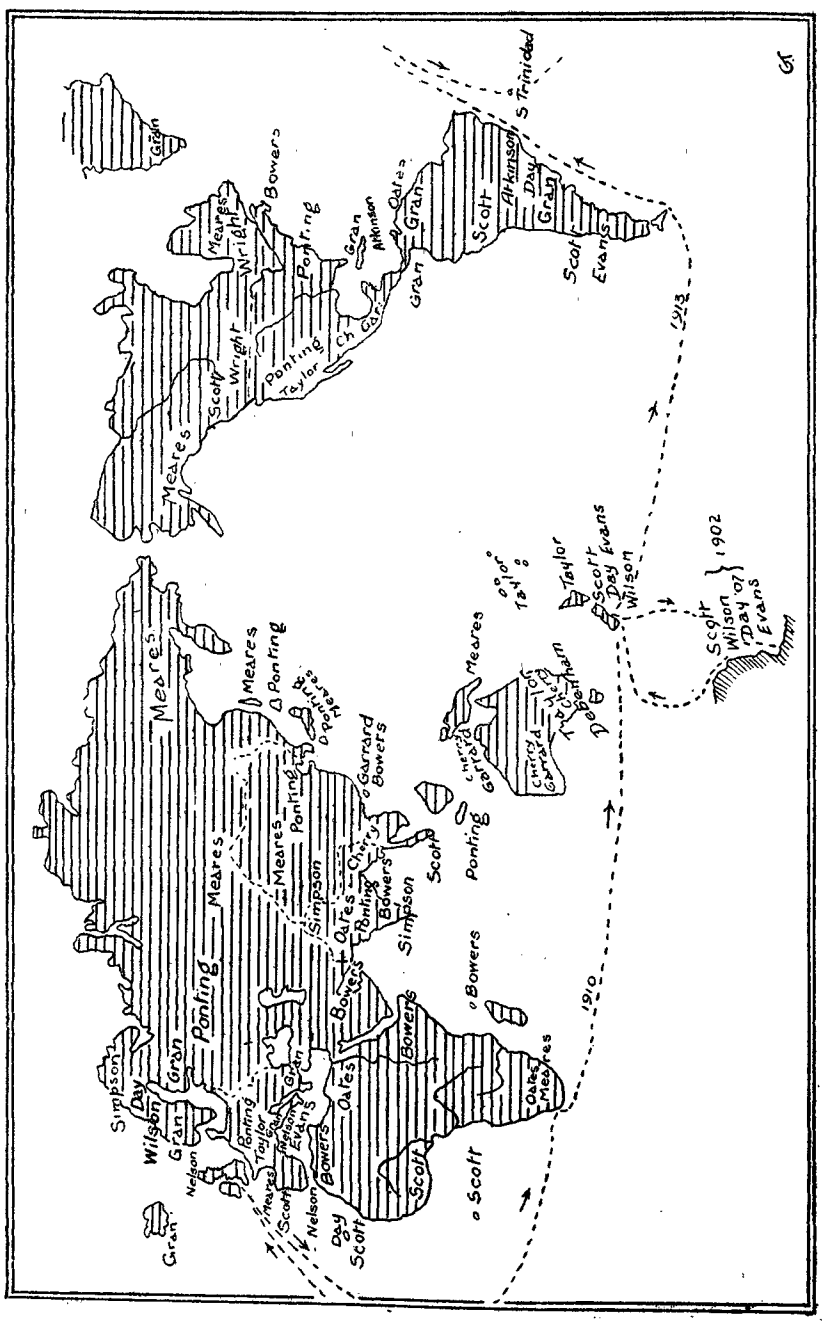
The third geologist appointed on Professor David's recommendation was Frank Debenham, scholar at my old university, and a family friend for many years. Indeed, the three sons of each family had gone to the same school, and five of us to the same university. It was extremely pleasant to be associated with men like Debenham and Wright, and I was indeed fortunate to have them as sledge mates in the difficult times to come.

By degrees all the party were assembling at the Antipodes. Meares had been collecting dogs and ponies in Manchuria. He had spent several years in this part of Asia, and was already renowned for his journeys into unknown Tibet. He passed through Sydney in October—accompanied by Lieutenant Bruce—a few days before I arrived.

Captain Scott, Wilson, and Simpson were now in Australia busy on various matters. During the voyage Simpson and Wright had carried out experiments on the electrical state of the air, and the latter was now engaged on testing and standardizing his pendulum apparatus before he left civilization.

On the 22nd of October, 1910, Debenham and I left Sydney for New Zealand. We were to join Captain Scott at Christchurch, and the *Terra Nova* was now lying at Lyttelton—the port of that city.

Some of the officers I did not meet until I reached New Zealand. There was Ponting, whose beautiful book on Japan had just appeared. He had had a most varied experience, including mining and ranching in California, before his genius in artistic photography manifested itself. He and Meares


Meares
Scott
Wright
Bowers
Ponting
Taylor
Gran
Atkinson
Oates
Day
Evans
Wilson
Simpson
Nelson
Pennell
Barne
Garrard
Cherry
Debenham
Keohane
Forde
Hooper
Lashly
Crean
Browning
Hodgson
Abbott
Clissold
Williamson
Dimmock
Hooke
Hayward
Lillie
Rennick
Kerr
Joyce
Hare
Lees
Weller
Hoare
Hooper
Lashly
Crean
Browning
Hodgson
Abbott
Clissold
Williamson
Dimmock
Hooke
Hayward
Lillie
Rennick
Kerr
Joyce
Hare
Lees
Weller
Hoare
1910
1911
1902
S Trinidad
Cape Evans
Hut Point
Discovery Bay
Glacier Tongue
Ross Sea
Ross Ice Barrier
Victoria Land
Mt Erebus
Mt Terror
Mt Discovery
Mt Morning
Mt Lister
Mt Markham
Mt Kirkpatrick
Mt Nansen
Mt Abbott
Mt Longstaff
Mt Hope
Mt Darwin
Mt Buckley
Mt Wilbur
Mt Cocks
Mt Dickason
Mt Dickason
Mt Dickason

were old friends, and had travelled together in many Eastern countries. Indeed, this fore-knowledge was a usual thing among members. Simpson had almost accompanied Scott in 1902. Wilson, of course, made his name on that expedition; and had been chiefly connected with the Grouse Commission since.

Cherry-Garrard was making an extended tour of the world when the expedition was started, and volunteered from Australia. He was the sole representative sent by the University of Oxford. He came out from home on the *Terra Nova*, and was one of the landsmen who took kindly to a sailor's life. A characteristic of Cherry's was his never-ending series of gifts to his mates. A most acceptable pair of huge Jaeger socks brought about our real introduction!

Captain Oates had seen service in many parts of the Empire. With difficulty one could get him to talk of his experiences in India (in the province of Indore) or in the South African war, where he served with distinction. He was very busy with the ponies during the voyage south, and I hardly spoke to him until we were marooned together in the Old Discovery Hut. One heard that he was a keen yachtsman, but his strong character and real sense of humour were hidden under a very quiet exterior. Our naval surgeon, Dr. Atkinson, and myself had no work in common until the same month of March at Hut Point brought us together when the Western and Depôt parties joined forces.

Perhaps the most interesting career among the younger officers was that of Tryggve Gran. He was only a few years over age, and yet he had seen more of the world than any member except Captain Scott. Born in Bergen, and educated in Switzerland, he had travelled all his life. He knew Europe from Turkey to Iceland, and shared with Simpson and Campbell a knowledge of Arctic life. He had fought rebels in Venezuela, tramped across South America, spent several years in the merchant service and navy of Norway, and was now a sub-lieutenant and a B.A. of Christiania. His chief record hitherto had been that of winning the Blue Ribbon of Norway, the Holman-Kol cup for ski-running. This narrative will have much to say of him, and will show that his versatility and willingness to help were remarkable even among the group of men who were my mates in Antarctica.

People have often asked me what attraction Antarctica had for me personally. It was purely scientific at first, but now I realize that the companionship with such ideal mates was the chief joy in Antarctic life. I have not, up to the time of writing, felt any of the "call to the Antarctic" that others describe; but travel anywhere with my mates of the South would be equally attractive.

At the risk of being tedious, I will try to describe the chief problem in science which I hoped to help solve by my sojourn in Antarctica. Briefly, it is the study of the effect of ice (chiefly as glaciers) in carving out the features of the earth's surface. It may quite legitimately be asked, "What is the value of that knowledge? What bearing has it on science and human interests?"

Most people know that Europe has passed through an Ice Age comparatively recently, but few—even among geologists—would be prepared to agree that almost every factor of human environment in Central Europe has been affected by this ancient ice-cap. All inter-communication, much of the agriculture, all the scenery; nay, even the very possibility of continuous habitation is due to the work of the ancient glaciers. The Gothard, Simplon, and Mont Cenis railways pass along deep glacier-cut gorges (see p. 9) until they reach comparatively narrow ridges which can be pierced by tunnels. The great Alpine passes are but cols due to glacial erosion. The fertile uplands (the true "Alps"), where the Swiss flocks pasture, and the extensive deep-lying plains of deep rich soil are glacial debris. The magnificent waterfalls, the tributary valleys "hanging" over the main gorge, are only found in regions where ice has played an important part in its past history. In winter it is only in these deep gorges, excavated two thousand feet below the general level in countries like Switzerland, that the inhabitants and their flocks can hibernate until the grass covers the country in the succeeding spring.

There can be no more valuable branch of geology than one which tries to chronicle the actions which have made the Alpine countries of the world so different from the more normal regions. But it is by no means universally allowed that this work is principally due to ice. One school of geologists maintains that water can carve out a land surface

in a simliar way; and in Switzerland, New Zealand, and similar regions, it is difficult to decide whether the living waters or the long-vanished glaciers have cut out a certain gorge or canyon. Where, then, is the solution to be found? We cannot observe Europe in the clutch of an Ice Age; but it is possible to find a region—once, no doubt, as warm as portions of Europe—now undergoing its period of intense cold and accompanying glacial erosion.

In almost waterless Antarctica the land is being slowly carved out into features which must be related to those obtaining in Alpine Europe and other elevated regions, if (as I believe) the Great Ice Age has left an unmistakable imprint of itself in a characteristic topography.

I may fittingly conclude the "series of introductions" by a list of the officers. This gives their positions; and, what may be found more useful to the reader, their nicknames and the personnel of the various parties into which the expedition split up on arrival in Antarctica.

LIST OF OFFICERS AND THEIR PARTIES.

Leader.—CAPTAIN ROBERT FALCON SCOTT.
Second in Command.—LIEUTENANT E. R. G. R. EVANS.
Chief of Scientific Staff.—DR. E. A. WILSON.

SHIP.

Harry Pennell, Commander R.N.
Henry de P. Rennick, Lieutenant R.N.
Wilfred M. Bruce, Commander R.N.
Francis Drake, Assist. Paymaster R.N. (retired).
Dennis Lillie, M.A., Biologist.
James Dennistoun (1911–12 voyage).
Alfred B. Cheetham, R.N.R., Boatswain.
William Williams, Engineer.

SHORE PARTIES.

A. *Northern Party* (Jan. 1911–Nov. 1912).

Victor Campbell, Lieutenant R.N.
G. Murray Levick, Surgeon R.N.
Raymond Priestley, Geologist.
(And Abbott, Dickason, Browning.)

B. *Depôt Party* (Jan. 1911–April, 1911).

Robert Falcon Scott, Captain, C.V.O., R.N. (The Owner).
Edward R. A. R. Evans, Lieutenant R.N. (Teddy).
Henry R. Bowers, Lieutenant R.I.M. (Birdie).
Lawrence E. G. Oates, Captain (Titus).
Edward L. Atkinson, Surgeon R.N. (Atch).
Edward A. Wilson, B.A., M.B., Chief of Scientific Staff (Uncle Bill).
Cecil H. Meares, in charge of dogs (Mother).
Apsley Cherry-Garrard, B.A., Assistant Zoologist (Cherry).
Tryggve Gran, B.A., Sub-Lieutenant (Trigger).
(And Keohane, Crean, Forde, and Demitri.)

C. *Western Party* (Jan.–March, 1911).

Griffith Taylor, B.Sc., B.E., B.A., Geologist (Grif).
Frank Debenham, B.Sc., B.A., Geologist (Deb.).
Charles Wright, B.A., Physicist (Silas).
(And Edgar Evans.)

D. *At Cape Evans* (Jan–April, 1911).

George C. Simpson, D.Sc., Meteorologist (Sunny Jim).
Edward W. Nelson, Biologist (Marie).
Herbert G. Ponting, Camera-artist (Ponte).
Bernard C. Day, Motor Engineer (Rivets).
(And Lashley, Hooper, Clissold and Anton.)

All those in lists B, C, and D were united under Captain Scott at Headquarters during most of 1911.

E. *Midwinter Party* (July, 1911).

E. A. Wilson, H. R. Bowers, A. Cherry-Garrard.

POLE PARTY AND SUPPORTS.

A. *Pole Party.*

Captain Scott.
E. A. Wilson.
L. E. G. Oates.
H. R. Bowers.
Edgar Evans.

B. *Last Support.*

E. R. G. R. Evans.
Lashley.
Crean.

C. *Summit Party.*

E. L. Atkinson.
C. S. Wright.
A. Cherry-Garrard.
P. Keohane.

D. *Dog Sledges.*

C. H. Meares.
Demetri Gerof.

E. *Motor Party.*

B. C. Day.
F. J. Hooper.

Lees. Paton.

Hooper.
Mather.

Photo by W. Hillsdon, Lyttelton, N.Z.]

OFFICERS AND CREW, CAPTAIN SCOTT'S ANTARCTIC EXPEDITION, 1910.

Left to right : Taylor, Wright, Simpson, Nelson, Levick, Oates, Evans, Bowers, Wilson, Scott, Campbell, Davies, Rennick, Ponting, Gran, Browning, Debenham, Day, Cherry-Garrard, Pennell, Meares, Drake, Bruce, Forde.

2ND WESTERN PARTY (Nov. 1911–February, 1912).

Griffith Taylor.
Frank Debenham.
Tryggve Gran.
R. Forde.

AT THE HUT (Nov. 1911 to Jan. 1912).

George C. Simpson.
E. W. Nelson.
H. G. Ponting.
Clissold.
Anton.

THE HUT PARTY DURING THE SECOND WINTER.

E. L. Atkinson.
E. W. Nelson.
F. Debenham.
C. S. Wright.
A. Cherry-Garrard.
T. Gran.

Crean, Forde, Lashley, Hooper, Archer, Williamson and Demetri.

They were joined by the Northern Party late in 1912.

II

THE *TERRA NOVA* GOES SOUTH *

* My thanks are due to the Editor of the *Melbourne Argus* for permission to reprint this section.

CHAPTER I

THE GEOLOGISTS VISIT THE NEW ZEALAND GLACIERS

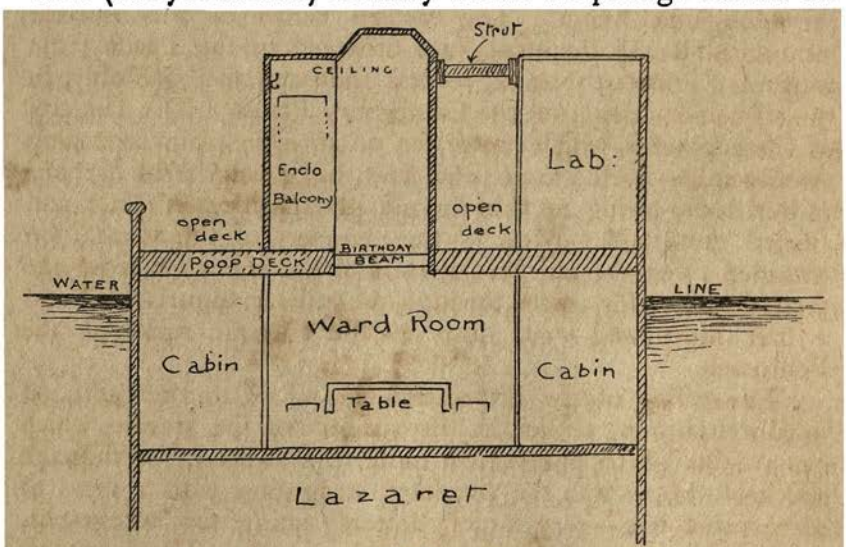
On the morning of the 4th of November the Australian contingent reached Lyttelton. The first ship we saw was the *Terra Nova* snugly berthed alongside the wharf, and separated by a few feet from the shed No. 5 in which most of the gear was stored. She was readily recognizable by her characteristic rigging surmounted by the crow's nest. The funnel is painted a rather vivid yellow, and is decidedly abaft of the centre of the ship, a feature which is usually represented wrongly in the models of the ship displayed in some of the Dominion's shops.

Technically the *Terra Nova* is a barque equipped with an auxiliary screw. She was built at Dundee, and carries three masts (two square-rigged), of which the mizen, for reasons explained later, is rarely used. Socially she is a Royal Yacht, which means that she may fly the white ensign, a privilege only accorded to certain favoured vessels of the Empire. In fact, I think, apart from our barque, all the units of the Royal Yacht Squadron are on pleasure bent; and certainly no other is frozen in the Antarctic Pack as we are at the time of writing. Originally she was used as a whaler, and differs little in general arrangement from the *Nimrod* (Sir Ernest Shackleton's ship), though she is approximately twice as powerful a vessel. Almost the only wooden vessels now built are those used in the polar seas, and as no steel vessel could stand the wear and tear caused by the constant collision with ice, it follows that an exploring expedition usually makes use of a converted whaling vessel.

When I first saw her in the West India Docks at London, she had a wide and spacious poop and a distinctly narrow and confined saloon. Now the proportions are reversed. The poop-deck consists merely of the space around the wheel and

binnacle; all the remaining area has been filled with laboratories and with two central structures, the deck-house and chart-house. Below, a relatively noble room has been provided; with an enclosed balcony much more useful and not much less ornamental than the classic specimen in Verona!

In naval parlance, our saloon is dignified by the title of "wardroom," and has none of the inconveniences usually associated with polar exploration. It is plainly furnished with a long centre table and two lateral leather-covered seats. The stove (not yet needed) certainly blocks the passage behind the



Section across poop of *Terra Nova* (not to scale).

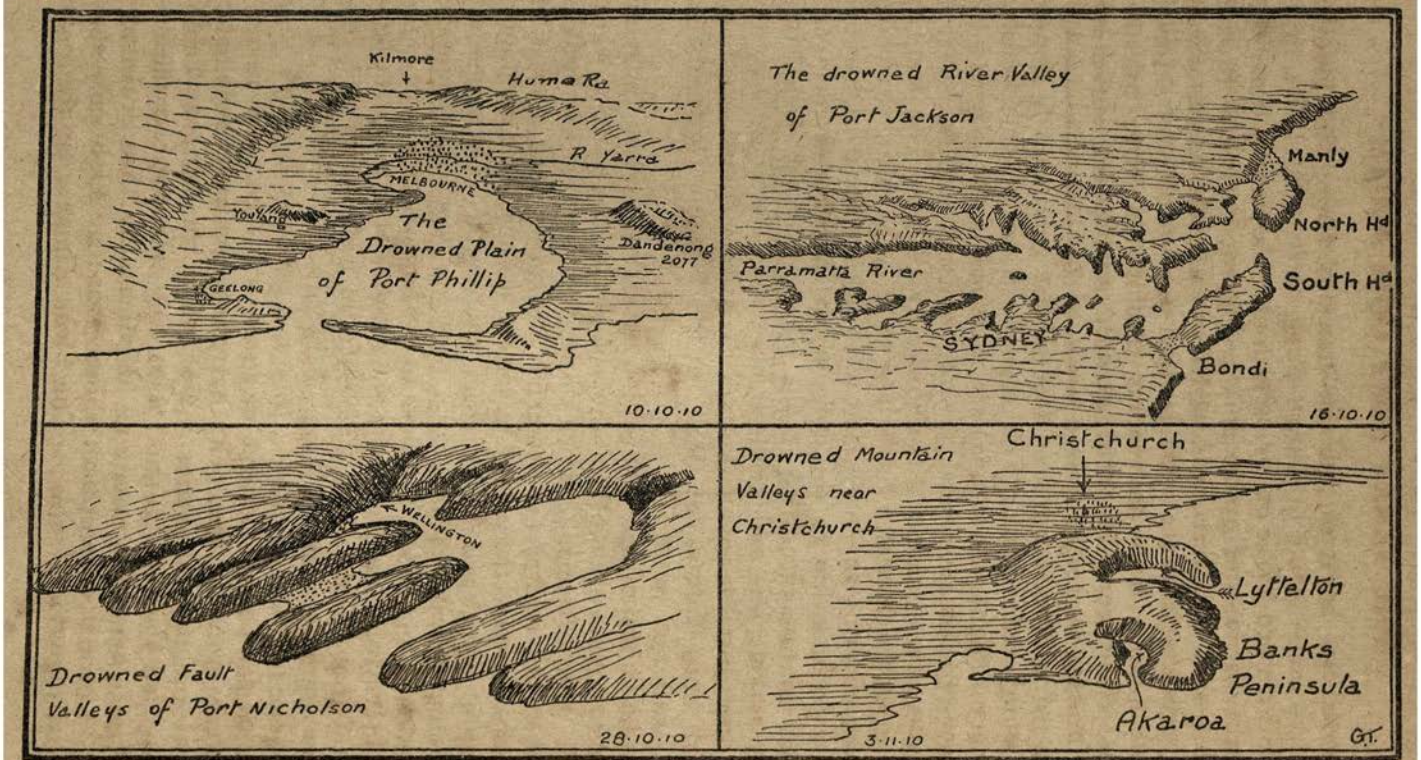
head of the table, but under normal conditions, especially before the expansive after-dinner moments, there is sitting accommodation for seventeen officers. Three more sit on boxes at three corners—the fourth being left open as a breathing space for the steward. Hence twenty of the twenty-four constituting the "afterguard" are accounted for, and the remainder are usually on watch, and arrive uproariously hungry after the majority have reached the tobacco stage.

On our early appearance we were cheerily hailed by the two officers on board. One had just converted the deck-house "balcony"—which overlooked the *wardroom*—into a bathroom, the other was devouring ham and eggs down

below. But most of the officers, after their four months' voyage, were staying in Christchurch some eight miles away, and came into the ship by early train. Lyttelton is a magnificent harbour of extraordinary origin. Port Phillip, it is well known, is a drowned coastal plain, hence its low banks and rounded contour; Port Jackson is a drowned river valley, as is obvious from its winding outline and deep frontage; while Wellington Harbour occupies earthquake landslides. But Lyttelton Harbour is a drowned mountain valley, with hills rising fifteen hundred feet almost continuously around the elongated basin. The eastern flanks of this isolated mountain (Banks Peninsula) are drowned in the Pacific; the western flanks are buried, several thousand feet probably, in the silts and shingle of the Canterbury Plains. The fair city of Christchurch, which has arisen on an even plain stretching twenty miles north, south, and west, has a wonderful harbour at her door, owing to this unique juxtaposition of plain and buried mountain. Most of the members of the Expedition tramped over the old bridle-track to see the view from the top, but all traffic passes through the railway tunnel—one and a half mile long—cut deep in the volcanic rocks of the Peninsula.

The office of the Expedition was close to the cathedral in Christchurch, almost in the shadow of the steeple, which has a habit of toppling down under the stress of earthquake shocks. Here was the secretary struggling with a mass of correspondence—very largely letters asking for autographs, penguin eggs, and rocks from the south. These modest requests, however pathetically they are worded, cannot be attended to in the last few days of preparation of a large expedition. More annoying were the sheaves of letters sent later on board the *Terra Nova*, addressed in such terms as "Mr. Wood-B. Pole-seeker, King Edward VII. Land." The addressees not being known, they will probably languish in a New Zealand Dead Letter Office.

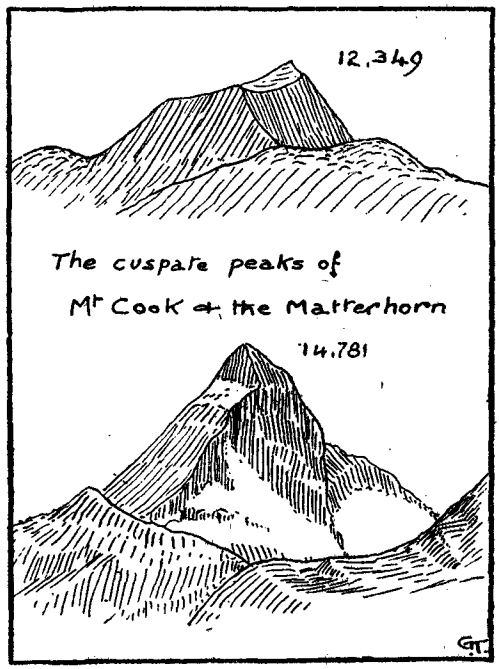
Captain Scott arranged that those scientists who were specially engaged in glacier investigation should immediately proceed to the New Zealand Alps to study polar conditions amid somewhat less strenuous circumstances than in Antarctica. I do not propose to do more than give a brief outline of the features of this region, which may reasonably be



Harbours visited on the voyage to New Zealand.

supposed to be analogous to those obtaining in Victoria Land.

We carried a pair of Norwegian ski as a present from the Expedition to the guide at the Hermitage below Mount Cook; and we were shod in Norwegian ski-boots, whose chief characteristics are a square high toe—to fit the ski-iron—and a large size—to contain comfortably three pairs of socks! We were also provided with some special surveying instruments, aneroids made of aluminium and only half the ordinary weight, and a queer type of hand compass, the shape of a gypsy's kettle. The needle was surrounded with a heavy oil and the case carefully sealed in, so that the oscillation should be "dead-beat," and not waste valuable time in coming to rest.

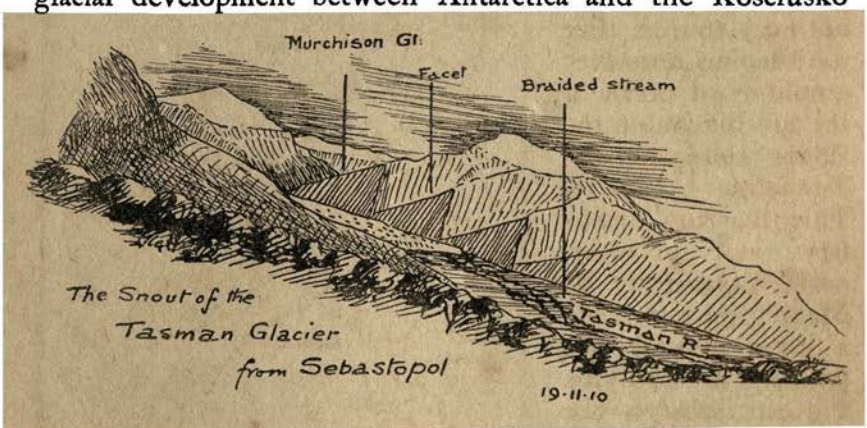


N.B.—In both these peaks and also in the Antarctic "Matterhorn" (in Taylor's Valley, *q.v.*) the "faceted" slopes are due to the eating away of the sides by cürm (cirque) erosion.

A hundred-mile motor ride bridges the gap between the railway at Fairlie and the Government accommodation house "the Hermitage" beneath Mount Cook. As we rapidly traversed the foothills—bare but for coarse tussocks of grass—the Alps came nearer and were more visible. The snowline was very strikingly marked on the mountains. To the north Mount Cook (12,349 feet) showed almost 7000 feet of snow, and thence as the mountains decreased in height less and less projected above the snowline, until on those 5000 feet high only the peaks retained any snow. The Swiss Alps are *in the same*

latitude (44°), but there the snowline is at 8000 feet, so that to get an adequate comparison of the two Alpine regions one must add on 3000 feet to the European peaks. Or, put in another way, there is as much snow scenery on Mount Cook (12,349) as on the Matterhorn (14,780), one of the highest peaks in Europe. It is a striking example, illustrating the fact that the southern hemisphere is, on the whole, ten degrees colder than the northern. For both Alpine lands are, as is said above, about 44° latitude. If we use the accepted factor of 1° F. decrease in temperature for 300 feet ascent, we see that ten degrees difference in temperature would alter the snowline 3000 feet, as is actually the case.

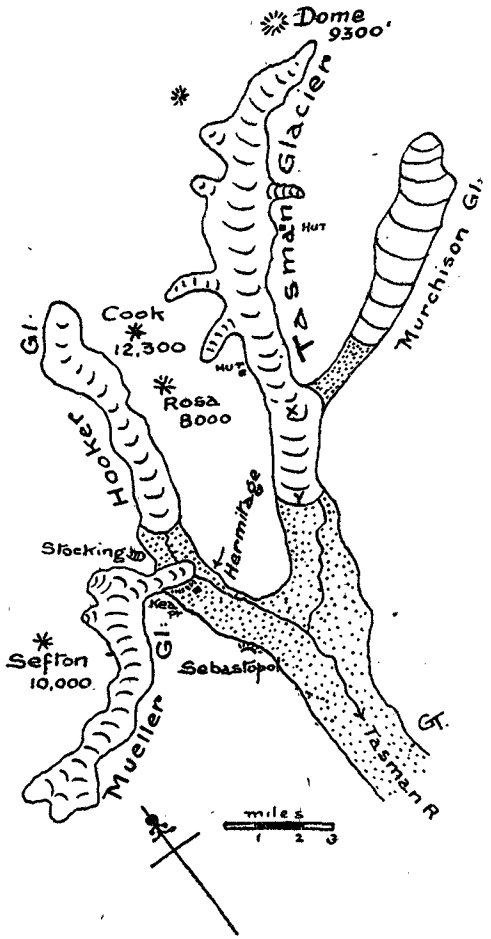
The Mount Cook region forms an interesting stage in glacial development between Antarctica and the Kosciusko



region in Australia. Later we shall see what are the appearances where the snowline reaches sea-level—just north of the Antarctic Circle. As we reach the Tasman valley draining the Mount Cook area, we are struck by several peculiarities in the scenery. There are no spurs projecting into the broad main valley, but each of the valley walls lies in one plane to a much greater degree than in normal valleys. Perched up on the high slopes are little hanging valleys, from which small streams cascade to the broad main valley. Along the slopes are lines of debris, like wandering railway embankments, which (though a thousand feet above the present river) mark the height of the ancient glaciers. These latter carved the undercut cliffs and left the tributary valleys up in the air. These signs are not wanting in the Australian glacial region,

where, indeed, they may be more obvious than in Antarctica, for they have been exposed by the retreat of the glaciation, whereas they will be to some extent concealed *beneath* the immense icefield of the south.

But in New Zealand are enormous glaciers, bigger than any in Europe, more accessible and (being under Government control) much more economical from the point of view of the ordinary tourist. Let us imagine ourselves a mile or so north of the Hermitage on the slopes alongside the Tewaewae Glacier. This hanging tributary is, however, never known by its Maori name, but by a more homely one (which can hardly be a *translation*) — the "Stocking."

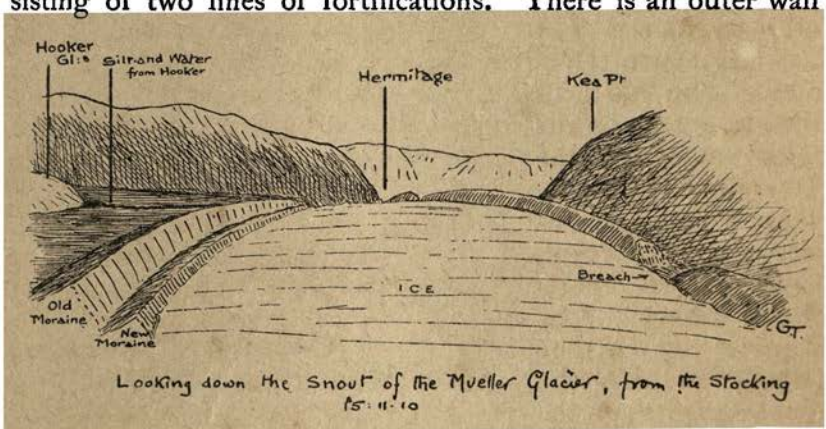


Map of glaciers in New Zealand visited in November, 1910, by the geologists. N.B. The Tasmanian glacier from X to Y is covered with moraine blocks.

Just below us is the junction of the Hooker and Mueller valleys, each containing a large glacier. We have crossed the lower portion of the Mueller Glacier to reach this spot. It hardly presents the features usually associated with glaciers by those who gained their impressions from written descriptions. Here it is a disturbed sea of debris, consisting of blocks of slate varying in height from twenty feet to a few inches.

Here and there large boat-shaped hollows show sheer black faces which glisten in the sunlight. Down these falls a constant stream of shingle, and occasionally a huge monolith tumbles with a roar into the body of the glacier. For there are ancient crevasses in the glacier, though it needs close inspection to see that their dark walls are formed of ice.

We must go several miles higher up the glacier to reach the clean white fields of snow and ice usually associated with the name. It is this tumbled debris—the surface moraine—which forms one of the most formidable obstacles to exploration of the coastal regions of Antarctica; while the smooth normal glacier surface is excellent travelling. All round the snout of the Mueller Glacier extends an almost circular rampart consisting of two lines of fortifications. There is an outer wall



Looking down the Snout of the Mueller Glacier, from the Stocking
15.11.10

some 300 feet high, curving grandly from the Stocking's wall right across the Hooker Valley, and thence above the Hermitage back to Kea Point. This is thickly covered with shrubs, and contrasts strongly with the somewhat lower inner rampart of new-piled blocks of slate. At first glance this suggests an ancient crater wall; but it is a glacial product, the terminal and lateral moraines shovelled out to the edges of the glacier by the ever-moving river of ice.

More striking still is the course of the water draining from the Hooker Glacier. This lies about two miles away to the north of the snout of the Mueller, and from ice caves in its terminal face a broad stream rushes to join the waters of the Mueller Glacier. It will be readily understood that in this small area, including the short ice-free strip of the valley

and the snouts of the two glaciers (depositing huge piles of debris), the deposits are very erratically arranged. Moreover, the waters of the Hooker actually hit the side of the Mueller Glacier, dip underneath for half a mile, and then reappear as a sort of miniature maëlstrom. I dwell on this because it shows how difficult it may well be for geologists in the year 10,000 A.D. (when the ice has long vanished) to explain the origin of the topography in such a region as Mount Cook. Much the same difficulty has occurred time and again in regions glaciated in comparatively late periods, such as in England, U.S.A., and even in the Australian Alps. One of the most promising features in Antarctic scientific work is the light it is bound to throw on geological phenomena somewhat like this, though on a much grander scale.

CHAPTER II

SHIP LIFE IN CALM AND STORM

THE few days between our return from the New Zealand Alps and the sailing of the *Terra Nova* were occupied by multifarious duties. The ship had been dry-docked at Lyttelton, and a bulkhead built across the fore hold. This space was filled with water, and the leaks detected where the water spouted out. At the same time the lock nuts on the four-bladed propeller were inspected by chipping off the casing of concrete in which they were embedded. A cross section amidships was almost rectangular. I was surprised at the enormous lateral bulges which almost made the boat flat-bottomed hereabouts, though she narrowed to a sharp overhanging bow heavily plated with iron. To a landsman the rudder appeared strangely long and narrow, almost like a simple vertical beam. But a broad rudder would project dangerously in floe work.

After caulking, the ship was brought back to shed No. 5, and the loading of the stores proceeded rapidly. On Friday (25th October) the dogs and ponies were brought across from Quail Island, some five miles higher up the harbour. Neither gave much trouble, and I was struck with the calm way the dogs endured the pulling and ignominious lifting by neck, back, or legs without retaliating. Probably our dogs are more gentlemanly than those of former expeditions.

The ponies are placed in stalls in the fore part of the ship. Four are just abaft the cook's galley in a strong shed, boarded up for four feet, but otherwise open in front. The mess deck —which may be described as the ground floor of the fore part of the ship—has been given up to the remaining dozen in similar stalls, six along each side. The seamen whose quarters have thus been annexed have gone one storey lower. The dogs were at first chained up everywhere—over the hatches,

on the deck-house, in the waist, everywhere except the poop. The two Peary dogs—somewhat larger but not so sturdy as the Siberians—are marooned in the alley between the laboratories and the deck-house, where they are tripped over every few minutes by some hurrying scientist. They are both black and indistinguishable to me, but are known—by a somewhat invidious juxtaposition of ideas—as Peary and Cook.

On Saturday, the 26th, a farewell address was given by the Bishop of Christchurch. It took place at noon on the poop, and was attended by all the members of the expedition and some half-dozen visitors. The time of departure had been fixed for three o'clock many days previously, so that every one was ready and there was no delay. We were accompanied to the Heads by half a dozen excursion steamers and tugs, and by numerous small launches. Guns were fired from the battery and from the warships at anchor in the port. A New Zealand flag floated on our mizen mast—presented by a local school. Many of the launches had kindly messages displayed. One particular large banner in the distance excited our curiosity. With the glasses we made out, "Excursion to the Heads, one shilling." What a descent from the sublime to the ridiculous!

At the Heads Captain Scott left us to join at Dunedin, but our most popular manager, Mr. Wyatt, accompanied us in his cabin. In anticipation of bad weather—which happily spared us—the newly joined members of the expedition devoted their attention to stowing their personal baggage. I must confess I felt this a hopeless task.

Our cabin measures six by eight feet. On the roof beam is cut, "Certified to accommodate two seamen," but four scientists and their belongings have spent a large portion of a month therein, and ultimately with little discomfort. But four wooden bunks and a wash-basin take up a large portion of six by eight feet. Our Antarctic clothing had been issued the day before we sailed—a solid block of woollen goods, with a canvas "sausage" four feet long which they filled completely. Four of these formed the *pièce de résistance* of our baggage. But each of us had another similar bag of ordinary clothing, and a box for books, etc. On top of this pile reposed a layer of sea-boots of enormous length and weight, but during bad weather beyond price. Cameras

and other delicate trifles were shoved in through the door, when one had managed to open it sufficiently.

I had no idea where we were going to bestow ourselves, but an old voyager explained to me how it was to be done. Obviously there was no floor space, no room for shelves, no cupboards; but the bunks (one above the other) are big solid wooden structures provided with four blankets and a thick mattress. A man does not need much more space than a coffin to sleep in, and these bunks were nearly three feet apart. It was almost impossible to fill that wonderful space beneath the mattress! I emptied into it two rucksacks of books, etc., one of the aforementioned "sausages," a drawing-board, all sorts of tools, diaries, hammers, bottles of ink, hunting knives. When this was safely under the mattress my sleep was not troubled by these crumpled rose-leaves.

The three new-comers were all geologists, and as such needed no laboratory on the ship, but the other scientists were able to stow away many articles in the physical, chemical, and biological laboratories. These palatial quarters will be described later, when it will be understood that this does not imply that *their* mattresses were free from protuberances. Wires festoon some of the bunks to eke out the accommodation. The space over one's feet is not wasted, for small wooden boxes are nailed thereon—or maybe a small bookcase. I thought that two of the shoulder-bags used in the Alps (known as rucksacks) would be most useful if hung alongside my bunk. This ingenious idea failed dismally, as will appear later. No one in our cabin has succeeded in controlling the vagaries of our ubiquitous water-can. It would appear to be an ordinary utensil of a brown-yellow colour, with a spout. But somewhere or other it has a pair of legs and a mischievous brain contained within it. And usually it is drunk with its powers for mischief, and is discovered on its side spilling water on our socks and shoes, or inebriate in another corner destroying all satisfaction in one's last dry change. It is only of late that we have had peace, for now only half a cup of water per day is allowed, and the bucket over the bulwarks serves all other purposes.

Let us pay a call next door—further for'ard, but still on the port side of the wardroom. This apartment is known as the "nursery." It is bigger than our dwelling, but needs

to be, for six stalwart explorers have their quarters there. Black envy at times embitters the friendly feelings between the neighbours, for has not the nursery a cupboard with a whole drawer (two inches high) to each inmate! A somewhat doubtful joy is theirs, however, for by far the most prominent piece of furniture therein—and, indeed, there are only two besides the cupboard—is a Broadwood pianola! One of the first I ever saw was in Samoa, twenty miles from a town, and owned by a native gentleman. In that case it was a separate attachment, and as his piano had lost many of the strings, little good resulted from the combination. But our pianola is a thing of beauty and a joy for ever. The new-comer notices a bulge in the ceiling—apparently of rubber—with a hose pipe attached thereto. This is a primitive but necessary adjunct to our pianola, and is, in fact, its little umbrella, which keeps it dry when the stormy winds do blow and poop-decks leak. The other piece of furniture, mentioned above, is a tall wooden cabinet, containing 250 rolls for the pianola. Although probably every member of the expedition has barked his shins thereon, yet all is forgiven when Wagner, Gilbert and Sullivan, Strauss, the Washington Post, or Ragtime tunes (not being a musician, I do not know the names of 245 of them) are echoing through the wardroom. Another trial to the men of the nursery is that their apartments form a short cut to the engine-room. It is only since we reached the pack that a constant procession of intruders, bearing unpleasing foot-gear and damp clothing (to spread on the cylinder head), has ceased to trespass.

Across the for'ard end of the wardroom is an important room dedicated to the culinary arts. Here the two stewards cut up succulent joints, and during a gale a merry jostling and jangling of countless plates and pannikins rival the notes of the pianola. The entrance to the wardroom is on the starboard side. It is beset with angles and pitfalls. When a visitor has safely negotiated the steep steps leading from the poop-deck, and turned sharply round to enter the wardroom, he is in grave danger of falling down a hatch to the lazaret and chronometer-room. Theoretically, when the hatch is open (about six hours a day) an iron bar is placed across the passage. Practically the natives feel with an exploratory toe in the dark entrance, and press on boldly if the hatch is down.

Opening on to these somewhat dismal surroundings is the cabin of Meares—the man of dogs and wild adventures in the Far East.

A large portion of the starboard side of the wardroom is occupied by the "owner's" cabin. Here are Captain Scott and Lieutenant Evans, the latter taking charge of the ship on its voyage south. The four after cabins (two on each side) are not quite so circumscribed as those of the scientists, but they are the permanent quarters of the navigators, while *nous autres* are mere birds of passage, and will soon be scattered over the face of Victoria Land.

The ship was hove-to just outside Lyttelton Harbour, and one had leisure to admire the wonderful coast-line of Banks Peninsula. Everything indicates a late submergence of this part of New Zealand. Inland valleys sloping *away* from the coast—relics of a former topography—are laid bare and chopped in half by the erosion of the waves. I strolled over to the top of the ice-house, where one of the junior scientists was sitting stoically among the dogs, and Lieutenant Pennell was bending over the large standard compass which ornaments the ice-house roof. He said, "You haven't a knife on you, have you?" I proudly pulled out the bowie I'd just bought with evil designs on Antarctic seals. He remarked, "You'll have to take that off. I'm swinging ship."

This consisted in rotating the ship as rapidly as feasible, meanwhile taking timed observations on the sun to obtain true bearings. By this means the total effect of the iron in the ship and stores on the magnet of the compass was ascertained. On leaving Antarctica next year this operation must be repeated. The aforesaid assistant was noting times when the observer called out "Top!" The actual swinging occupied about an hour, during which one could trace the devious track of the ship by the circular wake over her stern.

The Clerk of the Weather was kind to us, and our journey of thirty hours from Lyttelton to Port Chalmers was peaceful and uneventful. The farewell evolutions of Lieutenant Rennick on the poop-deck, whereby he sent and received messages which apparently afforded him considerable amusement, directed attention to the value of semaphore signalling in the frozen south. Next day might be seen eminent scientists wildly waving their arms according to the accepted code of

the Boy Scouts. Personally I prefer the Morse code, for it can be learned in ten minutes by a dodge which may interest my readers as it did the Antarctic party. Each sign is represented by a word or combination, which can readily be associated with the letter required. In these key-words *dots* are represented by vowels and the isolated letters *s*, *z*, and *h*; *dashes* by the consonants (including *w* and *y*). Thus A (dot, dash) is *an*; B (dash, dot, dot, dot) is *base*; C is *cāve*; *die*, *e*, *safe*, *gnu*, *hûsh*, *is*, *kit*, *aloe*, *Mr.*, *no*, *PQR*, *Epps*, *QRST*, *are*, *sss*, *t*, *usk*, *azov*, *awl*, *yell*, *bruz*. Of the remaining letters J is the exact opposite of B and X of P. It was rather a curious coincidence that both Dr. Simpson and myself became interested in these codes through reading a tale, "Raymond Frezols," years ago in the good old *B.O.P.*

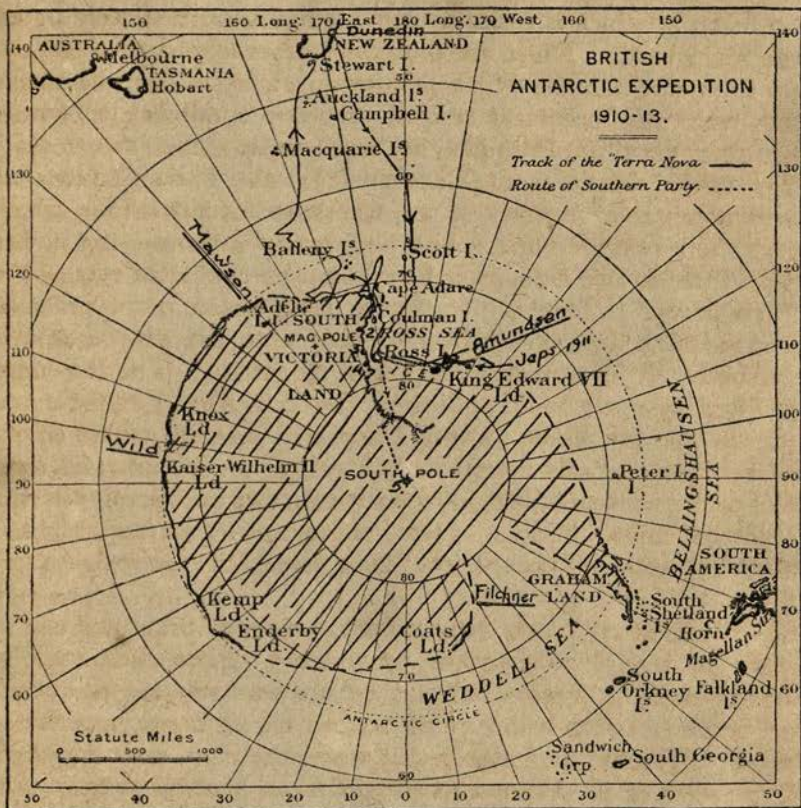
At dusk on Sunday the 27th we entered the heads of Port Chalmers. This is another drowned upland valley of a similar nature to Lyttelton Harbour. The novices in the after-guard chose this opportunity to essay the rigging. The scientists who had made the voyage from England lay out along the yard in fine style, in a manner which seemed distinctly precarious. Standing on a jumping "foot-rope," and leaning over the broad wooden surface of the yard, both hands can be used for furling the sails. When the next sailor gets off the foot-rope the latter jerks up a foot or more, so that this position one hundred feet above the water is not one likely to attract a nervous person. On this particular occasion it was too much for the hardy sailor man. The wind was dead astern, and we were burning Westport coal—which is a tremendous soot-producer, whatever its steam qualities are. As a result, a dense mephitic fog enveloped every one, full of sulphurous fumes, with clinging clots of soot. It was a weird spectacle to see the men working in what one might call a "Hades in the Heavens"—while elsewhere the whole atmosphere was calm and clear. Our photographer rushed out to try and get the effect, but the wind shifted slightly, and the men had come down for a breather. Soon they returned and made a "harbour stow" for the credit of the ship and the gratification of the good folks of Dunedin.

The most striking object in a polar exploring ship is undoubtedly the crow's nest. This is a large barrel, about four feet high, with a rudimentary seat therein, and a floor which

chiefly consists of a trap-door. After a good dinner on Sunday evening—which I note consisted of tinned bloater, sheep's tongue, rhubarb, and blancmange, with jam and potted meat (if the former edibles did not suffice)—I climbed up 150 feet or so of ratlines and reached the crow's nest. There are two stories or landing-stages on the way, the "maintop," about 60 feet up, which is quite a large platform, immediately under the main yard. There are two ways of reaching this—firstly, up the main ratlines, which bring you right under the maintop, when it is necessary to claw out by a small ladder—overhanging very unpleasantly at first—called the "futtocks." The other, simpler route—scorned by every true sailor, but very acceptable at first—is an accessory lateral ladder, which gets there just the same. Another pair of ratlines—the higher set a little to one side, as before—lead to the next stage—the "crosstrees." This is not a platform, but a mere brace of horizontal beams. Another 30 feet and the crow's nest is reached. It is a scramble at first to get in. The trap-door is lifted by one's head, and then the difficulty I experienced was to get my knees through, for the interior of an empty barrel does not afford much of a grip. It is not used until the pack is reached, but is then invaluable in tracing out the leads or lanes of open water, though, at that height, it is almost impossible to tell whether a floe is one foot or 20 feet thick.

Wednesday (30th November) was our first day out of sight of land. Shore-going suits were either sent back to Lyttelton from Port Chalmers or stored away in tin trunks on board. Little will they be needed for eighteen months or more. Fearful and wonderful were the rigs that appeared. Caps were of all shapes and sizes, from a Stetson with a backstrap to a red piratical nightcap. One member turned out in a salmon-coloured knitted confection, which by various foldings could be used as a cap, a cravat, or a purse (of the old-fashioned sausage shape). Coats of all kinds clothed us. A black leather jacket with the fur inside is much admired. This is worn by our Siberian traveller (Meares), and is suitably accompanied by a sort of fur busby of fox-paw fur. Norfolk shooting-coats are popular; one man braved the cold in a light-textured serge suit, such as clerks wear by the thousand. But a most welcome gift at the last moment of a

hundred grey jerseys furnished every man with a pair of beautifully warm garments that have in every sense driven all else under cover. They are rather large, so that when increasing cold necessitates more clothing this goes on under the grey jersey. Nether garments soon became fairly uniform also.



Map of Antarctica showing localities of recent expeditions. (1) Campbell, 1911; (2) Campbell, 1912; (3) Taylor, 1902; (4) Taylor, 1911; (5) Scott, January 18, 1912. Based on map from *Royal Geographical Journal*, July, 1913.

The special Antarctic clothing is being kept till we land, but by most of us nothing but the heavy corduroy trousers have been found thick enough to withstand the cold since we crossed the Antarctic circle. These trousers are extremely broad in the beam, rivalling a Dutchman's. But at the ankle

they fit tightly when buttoned up, so that they resemble a giant's riding breeches worn by a dwarf!

When Nelson ran short of thick breeches he made some by the simple process of cutting out a kilt of dreadnought blanket, putting in two brass eyelets and lashing it with string. As he had a red mob-cap, a sweater, and long sea-boots, he stalked about for days a living representation of Captain Kidd.

The official breeches are adorned with bone soup-plate buttons which displease some of the wearers, so that the bowie knives have come into play and cut them off. Tastes vary with regard to knives. Experienced men seem to prefer a shilling butcher's knife with a rough wooden handle; but the budding sailorman, if he has any money, cannot resist the ornamental daggers, ranging to two feet in length, with highly ornamental handles, cross-guards, and sheaths. For seal-killing these are practically useless, for the cross-guard prevents a deep stab, which is the speediest method of despatching the animal.

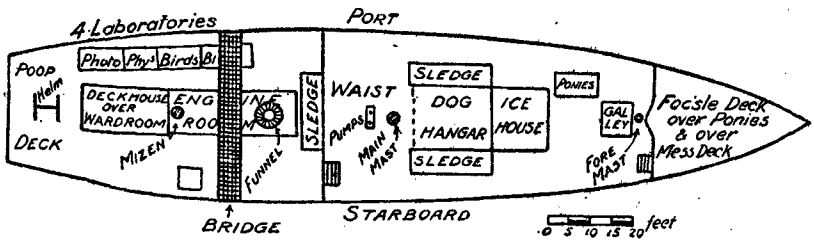
There is much variation in footgear. Our Canadian wears "shoe-packs" or soft-soled boots, with some resemblance to a polony in shape. During the earlier part of our voyage in the "furious fifties," every one used sea boots of leather, rubber, or leather and canvas. A local New Zealand brand were very comfortable, though heavy, and so long that, as an envious officer remarked, "they only needed braces to turn them into trousers." It seemed almost impossible to get wet in them, but in the gales we discovered they were waterproof from the quantities of water we poured out on changing them. This had all swept in from above, but was just as wet as if it had soaked through in the normal manner!

Every week increasing cold has led to a greater bulk of underclothing, but little change is apparent in the outer man. With plenty of food, plenty of blankets, and plenty of rope-hauling, the cold is hardly noticed so far.

The poop-deck was converted into a barber's shop the first day outward bound. Scissors were despised by the operators, who preferred horse-clippers, with which they simply and thoroughly removed every possible hair. Ponting (the photographer) has a specially close-cutting pair of clippers, designed to trim off frosty beards on sledging trips, and one

officer was so pleased with the first cut that he was retrimmed with the latter weapon. The result was very comic, and called forth enquiries from ribald youths as to when he was likely to hatch out!

We began the month of December with a spanking breeze in the most favourable quarter. The fore and main masts were clothed in sails. There is a huge boom on the mizen mast which swings over the poop-deck (as in a yacht) when in use, and carries a spanker, but the alterations to the poop and the presence of the funnel of the auxiliary engine so block the sails, and indeed to some extent offer the same obstruction to the wind, that our ship is to all intents and purposes a two-master. Howbeit, we bowled to southward at a rate of nine knots. The average speed of the engine is five or six knots, so that the sails were of great assistance. Indeed, when little



How space was utilized on the steamer.

cargo is in the hold she has reached the respectable speed or ten and a half miles per hour.

Let us take a walk around the decks in their present crowded condition. The last day of loading the supercargo announced that the engineer could have "two inches of coal."

This amount is not quite so small as it might seem. It was found that the ship was still two inches off her Plimsoll-mark (though one of the advantages of being a Royal yacht, I believe, is that she is, to a certain extent, freed from ordinary loading regulations), and as each inch of loading represented nine tons, this meant an addition of eighteen tons to our precious fuel. The most prominent cargo was, therefore, this coal, in bags, which were laid wherever there was any crevice to spare. The "waist"—as the deck between the elevated poop and foc'sle is termed—was several bags deep where it

was not occupied by the huge motor sledges and cases and cases of petrol. Many bags were deposited on the for'ard portion of the poop-deck. And over all sprawled the dogs. Much of this deck cargo—including all the coal—would be restowed later, the latter in the ship's furnaces during the first week. But "much water went over the bulwarks" (to misquote a proverb) before we reached clear decks.

Under the rising wind on the evening of the first, the water repeatedly came in board, and the "afterguard," comprising the non-nautical officers, were set to the task for which their knowledge was adequate, that of heaving coal sacks to the bunker manholes below the bridge. Slippery decks, soaking sacks, and swamping seas—for the wind continued to increase—made this by no means a pleasant task. It was often necessary to haul the sacks right over the engine-room from one side to the other of the ship. A sudden lurch and down would slip a leg between two cases of petrol while the sack fell on one's person, and "Peary" (or "Cook") assisted in the mêlée. One special mantrap consisted in the stiffening beams connecting the roofs of the laboratories and the deck-house. When the deck of the alley-way between was covered with sacks of coal a man's head was very liable to crash into these beams in the effort to escape a sea. I had that misfortune several times, and our headstrong Canadian friend's score must have mounted well into the 'teens.

Next day (the 2nd) the wind had veered to the west and south, and had increased very greatly; in fact, we experienced a full gale. The ship was hove-to for two days, and though we novices could see well enough that things were very lively, we did not know how grave a risk we were passing through. It was rather a rough breaking-in, for by this time our cabins were swimming in water. At first I rather selfishly hoped that my *lower* bunk would be protected from the thirteen Niagaras flooding the upper bunk by the floor of the latter; but as the storm increased in violence both were soaked—blankets, tools, books, cameras, everything except a foot or so at the head end.

Early on Friday (the 2nd) it was obvious that not much more could be done with the hand-pumps. The seas were incessantly washing over the waist—where the pumps are placed at the foot of the main mast—and burying the deck

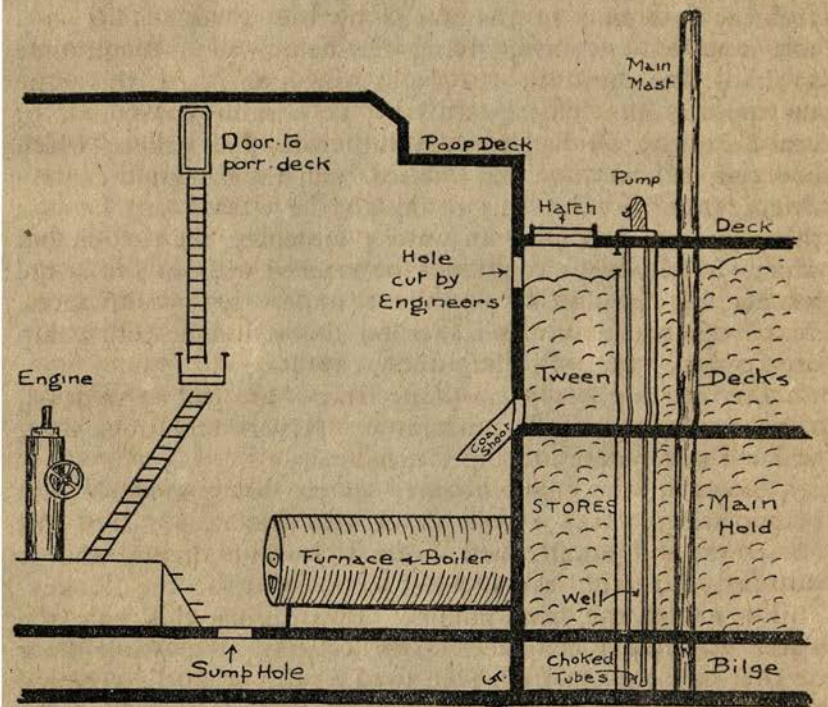
under several feet of water. Casks of petrol were drifting about and staving in ; the hammering on the port bulwarks was tremendous, and it was a risky business to get from the poop to the foc'sle. This was, of course, not unnatural in a gale, and would have caused little anxiety beyond that consequent on conditions of heavy lading and loose deck cargo. But it can be readily understood that water was finding its way into the bilge by a hundred channels with the constant sweeping of the decks by the waves. The poop was repeatedly washed, giving the helmsman a tough time to keep her head in the right direction. At this time the pumps all refused duty ! A curious compound of coal-dust and oil had formed into balls and pellets, which collected in the bilge and choked both the hand and engine-driven pumps. But this could not be cleared out because the bilge was feet deep in water ; moreover, the suction end of the hand-pumps could not be reached without lifting the hatches, an impossible expedient under the circumstances. Thus were we driven to a method almost unique with a ship of 750 tons—that of bailing out with buckets !

Day and night—in two-hour shifts—the bailing went on, until, luckily, the gale moderated. A very strenuous time, which I never desire to experience again.

Down in the engine-room floor are some movable iron plates, which cover a hole about two feet deep. Into this sump the bilge-water and normal leakage drains, and is pumped out with the greatest ease either by the donkey-pump or by the hand-pumps. But during this gale the water was nearly four feet deep, covering the whole floor of the engine-room from side to side, and gradually creeping up till it was in the ashpits, only an inch or two from the heated bottom plates of the boilers. If these latter were reached there was great probability that they would buckle, and practically ruin the boilers. Luckily there was no lack of unskilled labour in the persons of the after-guard, and they assisted the stokers by forming a chain from the bottom of the ship to the poop-deck. Three iron ladders with two intermediate platforms led from the floor plates to the open air, and a gang of a dozen men occupied this for twenty continuous hours.

Outside was the sound of the booming gale shrilling

through the shrouds and ratlines in one continuous shriek. Cold waves washed over the bridge, but luckily did not penetrate very rapidly through the sou'-westers, oilskins, and thigh-boots worn by every one. But while the upper end of the chain was in an Antarctic atmosphere, the heated waters washing about the engine-room filled the latter with a steamy, oily heat, so that several of the workers kept their clothes dry



Vertical section illustrating incidents in the great storm, January 2–3, 1911.

by leaving them behind in their cabins. Down below the sound of the rushing waters dashing from side to side with every oscillation of the ship was broken only by a cry of "Water" as the chain of buckets went up, and "Empty" as they descended rapidly to the bottom. Occasionally some one would raise a chanty, which was sung vigorously until breath failed through swinging up the heavy buckets. One of them was a shade heavier than the others, and it was always

a relief to be done with *that* one for a brief space. At the hatchway, luckily on the lee side, the end man held the empty buckets to prevent them washing overboard. He was kept moderately warm by the water from the emptying buckets, since being in the line of fire he received most of it amidships, whence it trickled down inside his boots, forming a novel mode of keeping the feet warm.

Now and again would come a welcome cry of "Spell Ho!" and those below would climb into the cool air, and those outside dive inside to thaw themselves. Then to it again till five minutes before the watch ended, when some one would be sent off to warn the relief. The relieved watch turned in, into bunks soaking wet in many cases, and by the time one had warmed up and snoozed a few minutes, there came a cry of "Turn out; your watch!" However, by Friday night we were holding our own and gaining slightly on the water. Meanwhile the engineers were working double tides to cut a hole through the bulkheads so as to get at the lower end of the hand-pumps. This was accomplished after many hours' work, and with the aid of a rat-trap the pumps were brought into use again. This humble implement was shaped to cover the end of the pipe, and served admirably to keep the coal-balls from clogging the valves. Soon sixteen men—eight on each long crank handle—were clanking away despite the incoming waves, and as the sea moderated the outrush from the hand-pumps assisted the steam-pumps so that on Saturday afternoon the ship was practically dry.

The toll of the gale was fairly heavy. Two of the ponies in the foc'sle stalls had died of the buffeting and exhaustion; one dog had been washed overboard; and the port bulwarks the whole length of the waist (about thirty feet) had been badly damaged. The after-portion for two panels (to use a landlubber's term) had been torn out bodily, while for'ard of that the planking was washed away, leaving only the framework. Personal gear suffered greatly. Books and diaries in my bunk had been pulped, a camera so warped as to be nearly useless, and several surveying instruments, which I had placed in a canvas rucksack on the wall, ruined or badly damaged. During the gale I had felt that the rucksack was quite dry, but on clearing out the bunk a little later I found the bag contained half a bucketful of a sort of "hoosh"—consisting

of rusty water, aneroids, compasses, and razors well mixed together! Waterproof bags have their disadvantages under such circumstances. In the log the gale is given the number 10, 12 being the maximum. We were unfortunate in meeting with it so early in the voyage; but, now it is all over, one is not sorry that for half an hour or so, in the words of Captain Scott, it was touch and go.

CHAPTER III

LEARNING THE ROPES

SUNDAY (4th) is a calm, restful day. I think most people on board slept well after the gale. "Rise and shine, Mr. Taylor, sir," is the curious reveillé of the steward at 7.30. I don't know how we are to shine, for I haven't had a wash for three days, except a bucketful of sea-water caught with my own (by no means) fair hands. Many of us have had all our suits soaked, and as to-day is really sunny and almost warm, some queer garbs are seen. One scientist reverted to a fashionable Tudor garb—to wit, a long speckled knitted tunic reaching the knees, and a pair of very long thick blue stockings! Now that the ship has stopped rolling through 40°, it is possible to wedge oneself among the stanchions under the deck-pump and obtain a bracing bath. But, as the gentleman who occupies the cabin under the pump ungallantly objects to the water, so to speak, killing two birds with one stone, and bathing *him* also, we are deprived of this pleasure, and revert to the even more chilly method of heaving up buckets from the vasty deep. The deck-house balcony—an enclosed strip of the poop overlooking the wardroom—forms our dressing-room, and was invaluable during the gale as a changing stage between the howling outer void and the snug wardroom below.

The first duty was to secure the loose boxes and cargo. The coal-sacks were all emptied into the depleted bunkers, and the cases of petrol for the motor-sledges transferred from the poop further for'ard.

A glance at the sketch-plan of the deck (p. 39) will show that the three enormous cases containing the motor sledges were almost as large as the permanent structure. Two of them, just in front of the main mast, help to form the walls of a snug

"hangar" or enclosure for the dogs. Large tarpaulins overhang at the sides, and partly cover the central space; and here the dogs are snugger than they are likely to be in Antarctica. On the port side the broken bulwarks have been roughly barricaded by ropes and planks; the narrow alley alongside being largely occupied by spare timber and scantling, on which three or four other dogs are chained.

A prominent building is the ice-house, with a flat roof, on which are two most important instruments and some half-dozen dogs. The ice-house has walls a foot thick, and contains carcases of sheep, with, I believe, just three of beef. It may well be believed that there is little need at present (latitude 68°) for careful insulation; indeed, half a dozen carcases have been preserved by hanging them in the rigging; alongside some penguins, though the latter are not for food, but consecrate to the taxidermist. Mention has been made of the standard compass—tested by swinging the ship early in the voyage—by which the helmsman's compass and various others on board are verified. In the centre of the ice-house is the range-finder—an historic instrument, which was used on the *Scotia* in her Antarctic explorations. It will be mentioned later, when the icebergs are described.

Merry are the meals we have in the wardroom. Gigantic meals; four per diem, and one extra if you are on night-watch. Eight o'clock, twelve o'clock, four o'clock tea, and 7.30 for dinner. Let me try and give some idea of a dinner, say, on Saturday night. About three-quarters of an hour beforehand the steward, who is dressed, as are the officers, in grey jersey and corduroy trousers, appears with the remark, "Table, sir!" This is a sign to clear off charts, calculations, diaries, and not unusually novels, from the oilcloth, that he may set the table. If any books are missing after this clearance it is safe to examine the "nursery," for our steward has a fixed idea that untidiness is a characteristic of the latter cabin, and so deposits findings on the pianola, whence they may emerge after many days. Tin mugs, bottles of lime-juice, ship's biscuits—either captain's or digestives—butter, and enamel jugs of water are the table furniture. As the bell is jangled the afterguard pour into the wardroom. Four men do not get seats, but if you stand up the range of action is much greater, so that it really compares favourably with a

seat. Captain Scott seats himself in the office chair at the head, and Lieutenants Evans and Campbell, if they are in time, sit next him. Dr. Wilson (chief scientist) has a fondness for the stool out of the pantry. I have a suspicion that his shrewd mind has realized that this combines the comfort of the seat with the mobility of the stander. The others sit where fancy lists; geologist next to pony expert, chemist, and motorman, taxidermist, navigator, lord of the dogs, doctors, etc., etc., each with his elbows lovingly exploring his neighbour's anatomy. Two of our 'Varsity men, from Cambridge and Oxford respectively, prefer an elevated perch on a "sausage," or clothes-bag, at the far corners. Perchance thus they feel like dons at their college high table. Enamel soup-plates are passed along, and the steward brings in two enormous jugs of pea or tomato soup. Meanwhile requests —one might say demands—of a nature strange to a landsman's ears fly across the long table. "Carry on with the bread, Marie!" "Give the butter a wind, Jane!" (pronounced "wined"). "Belay with the biscuit!" "Where's that drunkard's companion?" (This last remark, terrifying to a teetotaler, merely refers to a knife with a *corkscrew*, a very precious possession.) I should like to record the ship-names bestowed on my esteemed comrades, some of whom rejoice in three or four synonyms, but forbear, for personally I should hate it to be known that I—a staunch Imperialist—have occasionally answered to the cry of "Keir Hardie."

Soup despatched, plates of roast mutton are handed out from the pantry, with potatoes and beans, or some weird fibrous vegetable which was originally kale, I believe. Lime-juice is practically the universal drink, and is extremely palatable. Indeed, this and the mutton and butter are most excellent, while all the food is good. There follows plum-duff, roly-poly, apple pie, or stewed fruits and blancmange, surely the best sweets, if the homeliest, yet devised by cooks. By this time hunger's pangs are dying, and some one starts a chorus. We seem to prefer choruses of a rousing nature, though "it doesn't much matter what words we sing, so long as the tune hath a right good swing." For instance, "Rings on her fingers," etc. (or as the Canadian sings it, "Fings on her ringers"), is very popular. "My name is Gertrude," "Did she plant a tiny seed of love in —— —— stony heart?"

(with an honoured member's name inserted in the song) are always encored. Then, since it is Saturday night, "Sweethearts and Wives" is drunk in something stronger than the juice of the lime by about half the party. (I imagine this toast does not appeal to the other moiety.)

After dinner some dozen adjourn to the nursery for a concert. An upper bunk forms the dress circle, the washstand is the royal box, and the others crowd round the pianist. We have two flautists, two banjoists, and an expert on the mandolin, but are badly off for pianists. However, two of us can strum a little and are practising to eke out the performance. At any rate, there's no need for the piano except the final chord of the bar, for the goodwill if not the execution of the other performers is so great that the piano is lost. After an hour of "Scottish Student," the party disperse somewhat, except an enthusiast who plays favourite music on the pianola. Certainly ours is a quick-change programme; from "The Tarpaulin Jacket," rather badly strummed, to "Lohengrin," as played in grand opera!

By ten or eleven all but the watch have turned in, and we are one day nearer the Pole.

The 6th and 7th were days of dull weather, with some rain, and a wind veering to south-west, but we made good progress under steam, with just sufficient sail to keep her steady. As a matter of fact, in ordinary weather, she is a very steady ship, and anticipations of five weeks' mal-de-mer have in my case not been realized in the slightest. All but one unfortunate turned out throughout the gale—an heroic effort in the case of two of the after-guard, who had no interest in the dinner-bell for over a week.

Indoor work perforce occupied us, except when the setting of sails required volunteers at the ropes. I hesitate to describe this operation, for up to the present I have not been able to distinguish the "main weather braces" from the "fore to'gallant lee shrouds." However, I am busy learning them and the words of some of the chanties.

One of the most popular describes the adventures of a mythical hero, "Ranzo," who "was no sailor" at the beginning of the epic, but being taught navigation by an unusually affable captain, ends up by realizing that proud position himself! The chorus, "Ranzo, boys, Ranzo," is easily

remembered. Moreover, it is etiquette to pull only during the chorus. No wonder the sailorman loves this chanty. At the conclusion of the hauling some mysterious signal passes along the "centipede" of sailors, and the experts let go, while the novice is jerked forward off his feet by some one coiling the rope rapidly round the belaying pins. Then we troop back to the wardroom, leave our oilskins and sea boots in the "balcony," and resume our reading, writing, or embroidery. This last may seem unusual, but was a fact.

Many of the after-guard were provided with silken sledge flags given to them by friends before leaving. Others had had them made in Christchurch. One of the officers, nothing daunted by feminine and professional examples, boldly set to work and evolved a fine one under the jeers of his companions. The first sledge flags were carried in the north on the Franklin Relief Expeditions, and they are all made on the same pattern. They are three feet long and one foot wide, the end having a triangular notch a foot deep. At the staff end is worked a square St. George's Cross (red on white) while any desired design, such as a private crest, school shield or professional emblem, occupies the centre of the flag. A cord or ribbon of appropriate colour runs all round the flag. Some are very ornamental, and they will make a brave show down south. A maple leaf, and a map of Australia are patriotic signs. A flash of lightning adorns the meteorologist's banner. Shields of the Cambridge colleges are numerous, and several well-known schools, both in Australia and England, are commemorated.

Members of the party were soon seized by Dr. Levick in the interests of science. He was armed with a wonderful array of slips of coloured glasses, and with a simple telescope, across which the glasses could be inserted. With these he examined the colour of all our eyes, for it is maintained that there is a perceptible change in the iris after a sojourn in polar regions. I do not suppose green eyes would change into the more popular violet, but on our return we may find we have moved up or down his scale of colours; just as one learned ethnologist declares that the hardy Norsemen are Africans deteriorised by a changed environment!

In the evening a few of the after-guard may bring out novels, but there has been little time except a day or two in

the Pack for this relaxation. It is interesting to see how tastes differ. Some swear by Conan Doyle and dislike Merriman. Others find the White Company tedious (though they are rare) and revel in biography. One officer—with an eye to the penguins may be—is carefully perusing the "Amateur Poacher," while all of us have studied the book on Ski-Running. A most acceptable and suitable gift from Mr. Reginald Smith and others was a complete set of those handy sevenpenny and shilling books containing almost all the best English fiction of the last fifty years. They are well printed, fairly strong and not so valuable that one needs to don a dress-suit to read them. The strong book cupboard (now on the "balcony") will be a most welcome addition to our winter quarters during the long night.

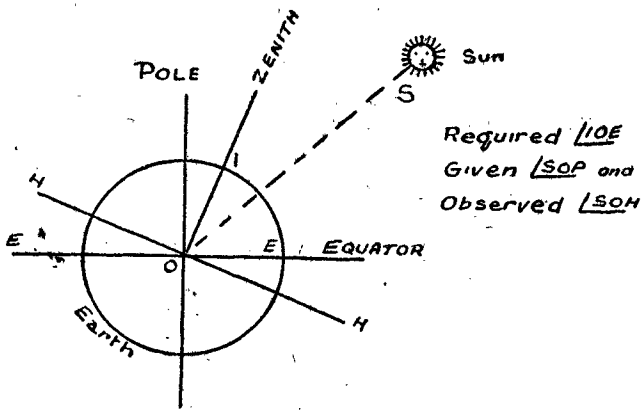
One problem, or set of problems, is engaging the attention of every class of officer, be he doctor, biologist, or geologist. It is that of field astronomy, for it is obviously essential that each sledging party should be able to locate itself fairly accurately by the sun or stars without reference to the natural features. The latter will probably be uncharted or—in the Barrier and plateau journeys—non-existent. It is not a specially easy business, but bulks largely in exploration, and I should feel proud if I can briefly explain the two simplest methods so that a layman can follow them.

Latitude is distance (in angular measure) north or south of the equator. The South Pole is 90°, and Melbourne 38° (subtended at the centre of the earth).

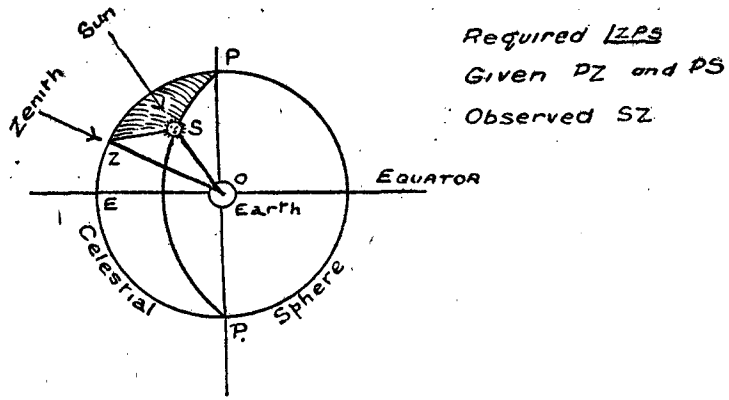
The sketch shows a vertical section through the earth, the polar explorer being supposed at I in the midst of illimitable ice plains. The position of the sun at midday is shown. With a sextant or theodolite he measures the angle between the horizon (H_1H) and the sun (which equals SOH). He knows the angle SOP; for this is given in the nautical almanac for the time of the observation. Now the angle IOE is the required latitude, and we have all the data needed to get it; as thus: Latitude, IOE = IOS + SOE = (90° − SOH) + (90° − SOP) (*i.e.* a right angle less altitude from sextant, added to a right angle less the almanac angle). By this short calculation the explorer can tell his exact distance from the equator; for a degree equals sixty-nine miles.

But he does not know whereabouts is his position on

this parallel of latitude. To do this we require the *longitude*. All that is necessary is to find the difference in time between that at Greenwich and the local time (as shown by the sun) in the aforementioned illimitable plain. A chronometer (a watch with a special compensation for temperature changes)



Latitude.



Longitude.

The celestial triangle is shaded. The earth is to be considered a point.

gives him Greenwich time; and the problem is to get the exact local time and to transform the hours into degrees by multiplying by fifteen (24 hours = 360°). Our next diagram is on a larger scale. We have increased our spherical surface so that the sun lies on its surface at S. A vertical line, OZ,

above our explorer hits this celestial sphere at Z. (The earth is really a mere dot at O compared with this huge sphere.)

Now we have a problem as clear as that involved in determining latitude. The position of the sun (S) on the sphere's surface is determined by the intersection of two lines, PS and ZS. Of these PS is tabulated in the almanac, and SZ, between the sun and the zenith (directly overhead), is measured by the sextant. The remaining side PZ of the triangle PZS is given by 90° minus the latitude EZ. Hence PZ the colatitude is known from our previous calculation. Given three sides of a triangle (even if it be on a curved surface), we can, as in Euclid, determine the angle at the pole ZPS. But this angle is the angle between the required meridian of longitude PZE and the longitude of the localities at that moment experiencing midday. It is extremely simple to find out what the latter longitude is, since we know Greenwich time from the chronometer. For suppose our chronometer says it is seven in the morning at Greenwich, then at this time it will be midday at 75° east (five hours difference) at Bombay. If our angle ZPS turns out to be 100° under these conditions (and we know it is midday at Bombay), our longitude is 75 + 100, or 175°; about that of Cape Crozier.

I feel rather proud of this explanation. I have never seen the problems so described before, and it has passed the critical review of a navigator. May it help every reader who may chance to be lost with a sextant and nautical almanac!

After the gale the dogs took some time to recover their normal spirits. We had heard that the Peary dogs were huge, ferocious beasts, ready to eat a man on sight. But they tamed down wonderfully, and, truth to tell, seem somewhat afraid of the stockier Siberian horde. It is prophesied that they will fall victims to the latter when shore fighting starts, and consequently they may be sent with the Edward VII. Land (or eastern) party. They are fed on biscuits, and (lately) on seal meat, and are certainly not kept very hungry, for one often sees a little food left. Poor Osman, the leading dog, was very sick after the gale, and was accommodated with some straw in an iron washing-dish. In this he curled up snugly, and recovered in a few days. The ponies and dogs consume about 80 per cent. of the drinking water; but the

latter were not so thirsty as expected, so that for some days each officer was allowed about as much as a dog in his cabin! Of course, with special soaps it is possible to get off a certain amount of grime with salt water, but fresh water is a great treat.

There are several pets on board. Firstly, a beautiful collie, who spends her time in the foc'sle, snuggled in some sacks. Then there's "Niggsy," the cat, "that walks," as Kipling says. Imperturbable, as usual, he tolerates fulsome fondling, and escapes as soon as may be. Smaller fry in the shape of rabbits and a guinea pig accompany us. Early in the voyage one of the rabbits seems to have challenged a pony to mortal combat. At any rate, its flattened carcase was found in the stall. Poor piggy inhabited a cigar-box on occasion, and this was carelessly dropped overboard one day, so that unless a crab-eating seal carries him there he will never reach Antarctica.

During the next few days the geologists were busy discussing the first sub-expedition in Antarctica. It will probably be of interest to readers to know how the amount of sledging stores is arrived at. It is a problem almost as intricate as a determination of longitude! The first factor to be considered is *time*. We will work backwards. The middle of March is getting very cold and dark, and this fixes the end of sledging. The *venue* of the proposed survey lies around Mount Lister, across MacMurdo Sound, and towering some 13,000 feet (see Map at end). Here, near Butter Point, three scientists (and perhaps one other officer) and a sailor will be landed from the ship as soon as possible after the winter quarters are well started. This may be about the 20th of January. The *time* factor is therefore two months.

Our programme will be approximately as follows:—To leave the ship at Butter Point and march two days up the Ferrar Glacier to Descent Pass. Here we depôt four weeks' provisions, and push on with two weeks' to the Dry Valley, which we explore and map. Meanwhile the ship has made another depôt (near the Dailey Isles) of a fortnight's stores, which we pick up on the 1st of March. So that we have to carry with us from the ship only *six* weeks' provisions, and of this only four weeks will need to be moved over long distances. So much for the distance factor.

A man can drag 200 lbs.; there are five men in the party, and the time is six weeks. Two pounds of food per man per day is roughly 12 lbs. a day for the party, giving a total of 500 lbs. food. One gallon of oil will last five men for a week and weighs with its tin 10 lbs. Hence for six weeks, say 70 lbs. oil.

Now for equipment. Two sledges weigh 130 lbs.; one tent, 35 lbs.; five sleeping-bags, 65 lbs.; finneskoes (shoes, etc.), total 50 lbs.; cookers, 25 lbs.; ropes, repair tools, ice axes, a spade, etc., total 70 lbs. Finally, since we shall have much rock work and hard glacier ice, a pair of Day's under-runners for the sledges—made of T steel—will be carried. They weigh 40 lbs., and the equipment amounts to 400 lbs. in all.

Instruments are essential, and weighty. One of the five-inch theodolites, specially built for the expedition, only weighs 11 lbs. Thermometers (two), aneroids (three), clinometers (two), hypsometers (one), prismatic compasses (three), hammers and chisels will add 40 lbs. to our load. For personal gear (tobacco, diaries, socks, etc.), one is allowed 10 lbs. each, totalling 50 lbs. Cameras and oddments, 30 lbs. Now let us see how the grand total stands :—

	lbs.
Food	500
Fuel	70
Sledges, etc.	400
Instruments	40
Personal gear	50
Cameras, etc.	30
	1090 lbs.

to be discharged from the ship at Butter Point. This, it will be seen, nicely balances the pulling power of five men, which (at 200 lbs. each) equals 1000 lbs. The party live day and night in the clothes they start off in, so that there is no load due to blankets or change of clothing. Non-smokers are, however, advised to carry a pair of socks instead of Navy Cut among their personal gear.

At any time now we might expect to see icebergs and the pack. From New Zealand we had been accompanied by albatrosses and petrels. During the gale it was almost comic to glance overboard during a rest from the bailing, and watch

the sea-birds swinging to and fro over the angry waves or even settling down on them. With perfect unconcern they carefully tuck in their wings and float quite comfortably in strong contrast to our position. On the 8th Dr. Wilson hung out a snare-line from the mizen shrouds. It was merely a long looped thin wire, without hook or bait. Soon one of the Antarctic petrels, as it swung back and forth in the wake of the ship, was caught in the snare and pulled in to join the zoologist's collection. The bird was dark brown with a white breast and a particularly fierce action with its pointed beak. So our assistant zoologist discovered when he posed before the camera and was requested to let the bird look pretty! The most curious feature was the central nostril in the form of a bone tube over the beak. This is the characteristic of the petrels and distinguishes them from the albatrosses.

CHAPTER IV

BLOCKED BY THE PACK ICE

On the evening of the 8th in latitude 63° 30′ we saw our first icebergs. We were just starting dinner when news was brought, and the soup looked tempting. So many times had "Wolf" been cried, that not a man moved! However, later some of us climbed the main rigging and far away in the east we could see two silvery pyramids glistening in the setting sun. Not even a fortnight's blockade in the pack has damped our admiration of the icebergs, and I shall have much to say of their striking beauty.

Early on the 9th of December we entered the zone of pack ice. On the horizon was an enormous fragment of the Great Barrier, probably three miles long, and one of the largest ever seen by those on board who knew these regions well. It was a tilted berg, so that the upper surface sloped considerably to the north. Most of these bergs float off from the Barrier in the shape of huge bricks. In this form they are known as tabular bergs. It often happens that large fragments of the lower surface break away, and in that case there is a readjustment of the flotation line, and the berg tilts over—as in the tilted example just quoted. Often the old flotation line is exposed on the side of these bergs as a furrow or line of caves cut by the waves. Still other bergs exhibit *pinnacles* and hummocks. It may be that these have actually turned turtle, or possibly they may be from shore *glaciers*, which have received ice debris from overhanging cliffs. Another group exhibit a broad *domed* surface sloping gradually from the centre. These are particularly difficult to explain, for neither the barrier nor the glaciers exhibit a surface of this nature, and it is difficult to see how it could have arisen after the berg left the parent body of ice. They may represent the large undulations seen in glacier tongues.

There had been little so far which came into the province of geology, but from this time forward the three geologists (Priestley, Debenham, and Taylor), and the physicist (Wright) formed an "Iceberg Watch." Day and night since the 9th every berg in sight has been noted and catalogued as tabular, domed, tilted, or pinnacled. All within three miles have been sketched and many photographed. Their distance has been determined by the range-finder, and their height by the sextant.

The range-finder is a tube four feet long, containing a prism at each end and an eyepiece in the centre. The instrument is mounted on a heavy rotating standard, and the observer looks into the *side* of the instrument (as it were across the middle), and not lengthwise as in a telescope. Through one prism appears the image of the upper half of the berg, through the other prism (which can be rotated on a vertical axis) the image of the lower half of the berg. Obviously, if the object is very far away, the rays of light constituting these two images are nearly parallel. If the berg is nearer, the movable prism must be twisted inwards to make its image fall correctly under that of the fixed prism. (From the end prisms it is a simple matter to deflect the images again into the same central eyepiece.) The amount of rotation of the right-hand prism measures the distance of the object.

A somewhat similar optical arrangement is made use of in the sextant. Here, however, a mirror image of one object is made to coincide, by moving an arm of the sextant, with the direct image of another object. The *angle* between the two objects—say the top and bottom of a big berg—is thus obtained. We have found the distance by the range-finder, and by a simple calculation can get the height in feet. The sextant will also give the angular *width* of the berg, and as we know the distance, as before we can find the width in feet.

Within a few hours of the first icebergs we reached the pack-ice. At first a few solitary spongy pieces of ice only a foot or two across, and so tumbled and broken by the waves that we were doubtful if they were not fragments of one of the bergs in the offing, rather than outliers of the true pack. But by noon we were cutting through it, and from that time it got thicker and more formidable as we penetrated southward. In this region (65° S.) it lay in long streaks across

our path about a quarter of a mile wide, and broken by lanes of clear water. After a heavy snowstorm at sea one finds the snow collecting into similar belts across the direction of the wind. The floe was here composed of pieces of ice about twenty feet across, and varying in thickness from one to three feet. These have just the appearance of pancakes coated thickly with icing sugar. The rounded outline is caused by the floes rubbing against each other, and as a consequence the edges are often slightly upturned. The contrast of the dark water with the dazzling floes is very striking. Imagine Gargantuan sugared pancakes floating in a sea of Stephens' "blue-black" ink, and you will get an idea of the colour-scheme of a field of young pack-ice.

As the boat hits this soft stuff there is a hustling and a surging, as one large piece collides with another, or even overrides it. Sheets of water sweep across the floes, and freeze almost immediately. The wake of the ship for a short time remains open, but soon the floes reassemble, and not for weeks do we see a horizon of clear water. Occasionally a floe turns turtle, and these deeply pitted lower surfaces of clear ice are very different from the level snowy surfaces of the undisturbed pack. The spongy floes on the northern edge of the great pack assume queer shapes. Here floats a large hollowed fragment like a waterlogged boat, whose sides project several feet above the water. There is a white cockatoo sitting on a log, with his crest angrily upraised. The crest might readily have been dyed yellow—though veracity compels me to admit it was not—for in places patches of intensely yellow ice, stained by microscopic plants (diatoms), are numerous. Again a swan sails proudly by, moulded in snow-white floe; while another bears the figure of a woman with hands outstretched in mournful supplication.

We have met the pack some fifty miles north of previous expeditions. We started a month earlier than Shackleton; but the *Morning*, only a week later, hardly saw any pack at all!

At two o'clock on the 9th there were twenty-seven bergs around us, mostly of tabular form. As we proceeded south the number of bergs steadily decreased until none were visible on some days, though usually three or four were in sight. This is but what one would expect. The greater part

of the heavy floe and nearly all the bergs have drifted north before the southerly gale from the Barrier. The bergs would be more affected by the wind than the low-lying floes, and so would take the lead in this pilgrimage to the north. A month later nearly all this pack will break away, and the entry to Ross Sea—which is an open sheet of water even in December—can be made without difficulty or delay. Thus, in the place of the fortnight we have taken, this belt between 65° and 69° could, under more favourable conditions, be traversed in two or three days.

For the benefit of the cinematograph, we took the ship close to a tabular berg which lay close to our course. From the crow's nest the officer of the watch was able to see the submarine ice-foot, projecting like a battle-ship's ram from the lower portion of the berg. The visible part of the berg was about three hundred feet long and some seventy feet high.

Along the water's edge were several large caves, excavated by the waves and coloured a vivid blue. A most interesting feature was that the layers of the ice were horizontal in the upper thirty feet, but quite steeply sloping in the lower visible layers. This pointed to some change in position during the growth of the Barrier from which this berg was calved. There was, in fact, what geologists would term a "strong unconformity." "Iceberg" is a loose term to apply to these Barrier fragments; for they are largely consolidated layers of snow, and one can detect almost every type of material, in the series from coarsely granular snow to true ice, in one or other of the bergs.

On the 10th, at 5 a.m., we crossed the Antarctic circle (66° 23′) and reached the lands (and seas) of the midnight sun. For two reasons I stayed up to welcome him. Firstly, because I had not had the pleasure before, and, secondly, because I had to. My particular portion of the watch lies between the hours of 8 p.m. and midnight—the best watch, in my opinion. One has not to turn out of a comfortable blanket as in later watches, and can share in all the incidents of the day, from which officers on watch are debarred.

The time is 11.45 p.m. I am sitting on the foc'sle with unbuttoned coat and no gloves. When there is no wind one does not feel at all cold. It is perfectly bright; not only light, but so bright that the sun's rays through the cabin

portholes below are too strong on one's book. In the south-east is a low bank of grey-purple cloud, whose lower edge is turned into a vivid golden ribbon by the never-setting sun. We are threading through lanes between floes some four feet thick. Sometimes we move bodily through the ice. Occasionally she strikes a floe, on which our ironshod bow makes no impression. High above us the officer on the watch cries out, "Starboard, one turn." From the poop comes the answer, "Starboard it is, sir," and our ship sidles her way to port. (This paradox is a relic of the days of the tiller.) She reaches a crack at the side of the obdurate floe, and slowly creeps towards the golden clouds. Far ahead of us two geysers shoot suddenly into the tranquil air. They appear again to the west and mark the path of two whales. Around the ship circle two or three snowy petrels, beautiful little birds that resemble white swallows and never appear north of the pack.

Let us climb into the cross-trees—an unpleasant task with ungloved hands in any but a calm like this. All around us lies the pack, no longer like pancakes, but much thicker, and resembling shortcake (to keep to homely similes). In plan it has been compared to the pattern of our wardroom tablecloth, that white mackintosh crossed by irregular meandering blue lines. In the west the moon is reflected deep down in the still, dark water. To the north the heavens are crossed by arcs of salmon-coloured clouds, under which we passed several hours ago. The sea is coloured a vivid brownish-pink between us and the northern horizon. It has an oily sheen, which reminded me of nothing so much as the appearance of soft putty—though I fear this is not a very artistic comparison. Looking back on our course, we seem to have left a long dark line extending indefinitely to the north. This is the Antarctic shadow of the sun, for we are steaming straight for the latter. By this time we can notice a perceptible increase in the elevation of the sun. At home he sets in the west and rises in the east. In these regions both events may be described as occurring in the south. Eight bells has just sounded and my watch is over.

On our second day in the pack the floes had become much thicker, and soon after breakfast we heard the cry, "All hands on the floe to take in water." The ice anchor—a large bar of

ICING SHIP IN THE PACK ON THE STARBOARD QUARTER, DEC., 1910.

The lifeboat was carried away in the gale of March, 1912. The carcases in the rigging are New Zealand sheep. The bridge, protected by high canvas screens, is visible behind the lifeboat.

THE NORWEGIAN DINGHY OR PRAM RETRIEVING BIRDS IN THE PACK ICE, DEC., 1910.

The ship is fastened by the cable to the pack ice.

iron bent like a rough fish-hook—was fixed in the floe, and stout ropes looped round projecting hummocks. This particular floe, in the place of being perfectly flat, and only a few inches above the level of the sea, was covered with large blocks of ice some four feet long and two feet or three feet through. A fragment of these blocks when tasted was found to be sweet, so that here, five hundred miles from Antarctica, we had an abundant supply of water, not only for the boilers, but also for drinking purposes. Probably these fresh-water blocks had dropped on the floe from some disintegrating berg—for the latter, as explained previously, were originally beds of snow.

The ship, with its attached floe, drifted gradually to the east, and a merry scene, lasting some hours, now took place. A sloping board was placed against the ship's side, and from this a stout plank led some distance over the floe. With pickaxes and crowbars the crew and afterguard attacked the ice blocks. These had a bad habit of splitting into useless crescent-shaped fragments, but sometimes the crowbars would wedge off a piece the size of a cabin trunk, and this could then be broken into fragments of the size of a football with ease and celerity.

The surfaces of smooth ice were very slippery, and led to several grievous tumbles which awakened more merriment than sympathy. Occasionally, in prospecting for a fresh quarry, the pioneer's foot would slip through the floe, and he would realise with a shudder that *terra firma* lay 11,784 feet below him. (We sounded, with this result, earlier in the day.) However, such slips led to nothing but wet clothes, and they were not sufficiently novel to excite remark. A chain of men led from the quarrymen to the plank, and blocks were tossed along to slide from the plank to the wooden ramp, and up this with a "Yo-heave-ho" to the deck. Nearer labourers would send their contributions hurtling through the air, with a warning cry of "Fore!" that was not always heard. This animated scene attracted our cinematographer, and his battery opened on us while the sport waxed fast and furious. In the open lanes around the floe our Norwegian dinghy (or pram) was manœuvring, retrieving birds shot by the zoologists from the poop. Nearly a dozen were shot for museums without difficulty, for the innocent creatures continued to swoop around

the ship in spite of the havoc wrought upon their companions. When some half-dozen tons of ice had been collected, we cast loose from the floe—now levelled like its neighbours—and steamed to southward. The blocks of ice were gradually transferred to melting-tanks over the engine-house, and gradually the whole heap was converted into water.

Now that our environment had so changed, we met with a different and much more interesting fauna. I have mentioned the snow petrel, and on the same day we first met the Adelie penguins and the Crab-eater seal. We have seen plenty of penguins since, but I shall never forget the forerunner. He waddled towards us exactly like a tiny child learning to walk, who runs quickly to his mother, knowing that a topple at the end does not matter. Then he would stop and flap his wings (I was going to say arms), and bow and turn his head around in a most human and unbirdlike way. The most striking feature, I think, was the stiff little tail which he dragged on the ground, and which probably helped to support him. It is formed of a few stiff black feathers, consisting of little but the quill, and adds to the comicality of the bird. The colouring of pure white breast and black back reminds one of a stout little man in a swallow-tail coat and white shirt—both much too big for him!

At three in the afternoon I heard our battery of guns in full action, and rushing up on deck found that a family of four seals had met their doom in the interests of science and of the kitchen. A few hundred yards away lay three of the seals dead in their tracks, but one poor beggar had crawled to another floe before receiving a fatal bullet. Several lanes of blue-black water separated the floes, but the pram was quickly put overboard, and six of us made for the seals. A hawser on to a hummock on the smaller floe brought the latter near the ship, and then we dragged the large crab-eater (eight feet six long) to the ship's side, where she was hoisted on board by the crew. Then a short passage in the pram brought us to the other floe, and a similar proceeding enabled us to get the rest aboard also.

Of the four specimens only one was a male, and he was not full grown. The largest female was over nine feet long. In colour they were a dirty yellow-brown above and paler below. The young seals were prettily dappled. All four had

cruel scars a foot or more long on their flanks, some barely healed, which were due to the attacks of killer whales. No one seems to know why they are called crab-eaters, unless perhaps because they never eat crabs. Their chief food consists of small shrimp-like animals called *Euphausia*, which they devour in great quantities. The shrimps live on the yellow diatoms which encrust the lower surface of the floes. The seals have rather large, strong teeth, but these are of little use to them, and are a relic of bygone days when the seal had hind legs like his cousin the otter. Very sinuous and graceful is a seal in its native element, but on the ice its method of progression can hardly be called beautiful. It wriggles along with rapid undulations of its body, more like a large slug than a mammal. In death this floppiness of structure—I know no more expressive word—made it difficult to handle the weighty carcases. Before skinning they were carefully measured by Dr. Wilson and Cherry-Garrard. Clad in overalls and armed with keen knives, the two set to work, and soon separated the skin and blubber from the carcases. In these seals the blubber formed a continuous firm white layer about an inch thick, though in the Weddell seals further south it is often much thicker.

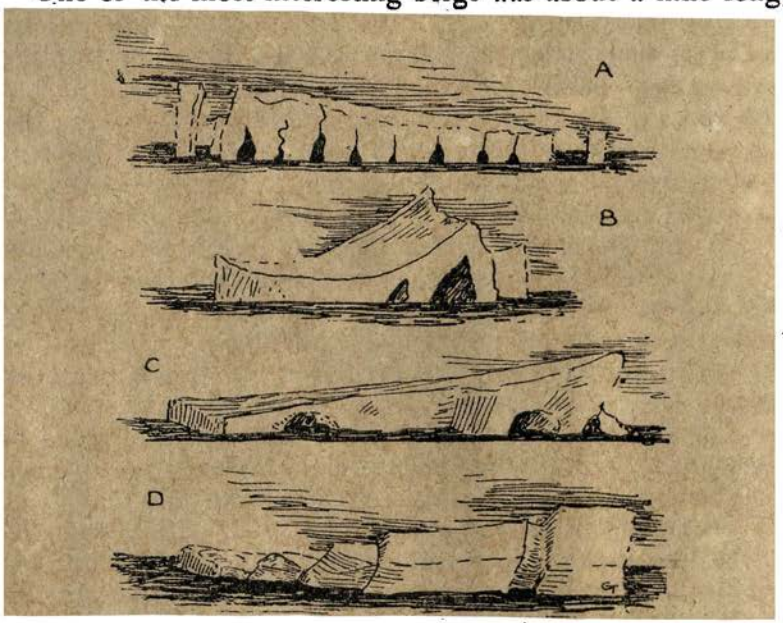
The skeletons as well as the skins are to be preserved for museums. As much flesh is cut off the bones as possible, and the remainder gradually dries into a sort of "biltong," and has no smell. The flesh was served to the dogs, who soon got to like it, while the livers were cooked for the wardroom, and tasted most uncommonly good, even in our present state of plenty. I can well imagine how a returning sledge party looks forward to seal's liver at headquarters.

Next day Dr. Wilson rigged up a "flensing" table for freeing the skins of the blubber. It is a wooden arrangement, very like a large saddle-tree, forming a handy sloping surface on which the skin lies while the blubber is pared away. The blubber was commandeered by Dr. Atkinson for his patent blubber stove, which is going to help warm the hut down south. The blubber is fed into a tin dish surrounding the chimney of the stove. Here it gradually melts and runs down a narrow pipe, which enters the stove and is curved over the floor of the latter. Out of this curved "burner" the oil drips continually, and gives a hot flame. The waste heat passes up

the chimney, and renders more of the blubber; and so the operation proceeds. Of course some coal is used at first to warm the blubber-melter, but thereafter it seems to burn well, and certainly gives off very little smell.

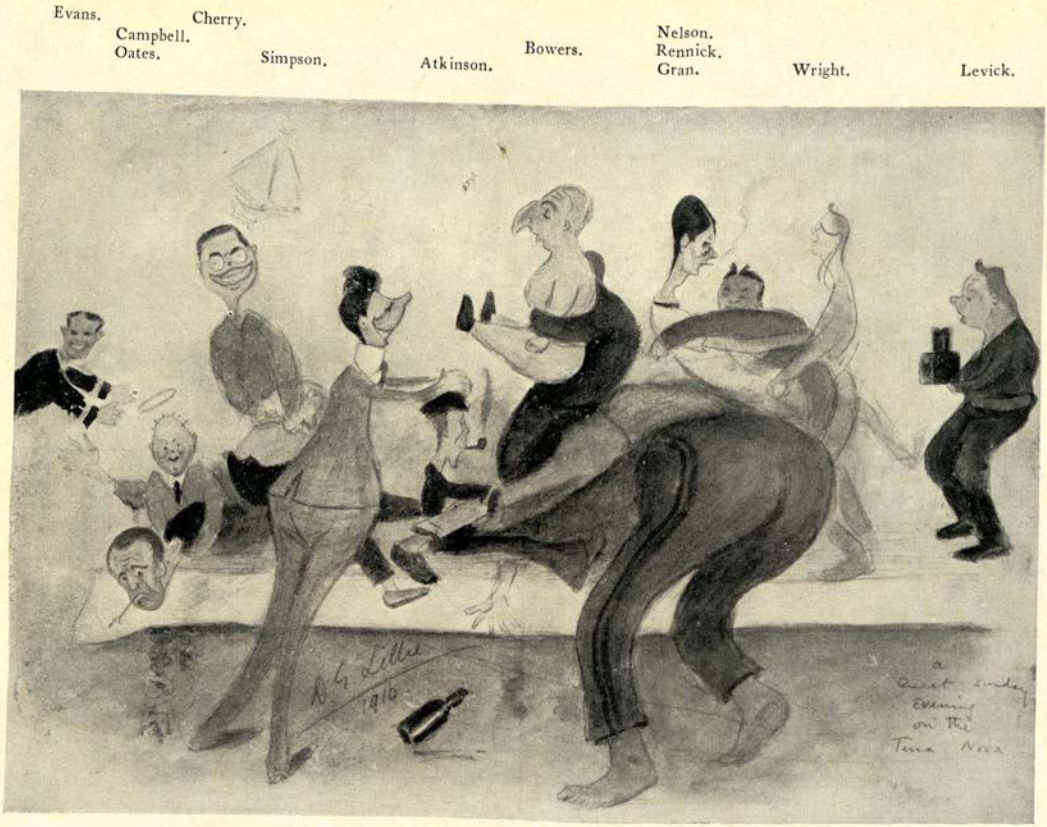
During the past few days the "iceberg watch" has been kept very busy. All shapes and sizes of bergs have we passed, giving rise to many arguments as to their mode and place of origin.

One of the most interesting bergs was about a mile long,



Icebergs seen December 8, 9, 10, 1911, latitude 22° 5′. A. Showing vertical points; B. Probably overturned tabular; C. Tilted tabular with fine caves; D. Faulted tabular berg.

and had originally been tabular. All along the face were enormous vertical cracks ("joints") broadening into sea-caves below. These had split the berg into columns and it was wonderful how it held together. Probably the portion under water had not been eroded by the waves, and still remained fairly solid. At each end was an isolated pillar a hundred feet away from the main mass, and one was over a hundred feet high. It exactly resembled the classic geological example of coast weathering "The Old Man of Hoy," a detached piece



A QUIET SUNDAY EVENING ON THE *TERRA NOVA*.

From a sketch by D. Lillie.

of sandstone in the north of Scotland. The similarity was really not wonderful, seeing that the method of sculpture on jointed material was identical. Another irregular berg reminded us of a boar's head in profile. Two pinnacles formed the ears and a cave represented the eye. This specimen was probably an overturned tabular berg. A tilted berg was crossed by cracks, which had led to "faulting." The ice between two cracks had slipped down and a beautiful "fault valley" was the result. These examples of what has happened on a larger scale in the earth's crust were very interesting to the geological members of the party, and are preserved in photographs or as sketches. Debenham has made a series of pen and ink drawings which are especially illustrative of their structure.

Later in the day a travelling troupe of four penguins entertained us. We first saw them a few floes away, engaged in a sort of minuet. First they would meet in pairs, and then all crowd together, and after some setting to partners they waddled towards us. Soon they came to a break in the floe, and one ran along it till he saw an edge free from ice-frost. Then they dived in "follow my leader," and came up with a "plop," all standing, on the next floe. One after another they shot up a couple of feet and came down erect with a bounce. By this time they had approached the ship, and formed up in line uttering an occasional squawk like a crow. We threw down a potato and a lump of coal. Two tackled each article, and much confabulation ensued. The coal partners summoned the potato people to a consultation, and when they of the vegetable were fully engaged the other pair quietly sneaked their property. Penguins are very human.

On the 11th we were held up all night by the pack, and this experience occurred but too often in the next fortnight. Let us glance around and see how the afterguard spend this enforced leisure. Dr. Wilson is seated on a box in the chief cabin, turning out water-colour sketches of birds and icebergs. A cry of "Crab-eaters on the port quarter" is raised, and up rushes "Dr. Bill" with notebook and rifle, ready to use either on the potential specimen. Nelson is dragging in a large tow-net, in which he captures medusæ and Euphausia and other wild fowl. Secluded in his laboratory Lillie divides his attention between the microscope and a series of extremely

clever caricatures of the afterguard, each of which arouses uproarious merriment in every member save one. Drake is busy transcribing the ship's logs, both general and meteorological, and usually manages to annex a large portion of the wardroom table in the process. Alongside him Dr. Simpson works out his interminable magnetic observations. Lieutenant Gran, our Norwegian companion, is busy getting the ski from the forehold and supplying them with the necessary straps. On the poop Meares discourses of dog-harness in a weird sounding language to the Russian grooms. Cherry-Gerrard is skinning penguins and wrapping the skins neatly in brown paper. The carcases are handed over to the cook and appear as a pilau at dinner. Day is busy with chamois leather, coloured glasses and a cutting board, manufacturing spare snow-goggles. His articles are in much request, for they are more comfortable than the official pattern. Lieutenant Pennell is in the crow's nest, peering ahead to pick out a possible lane through the thick floe.

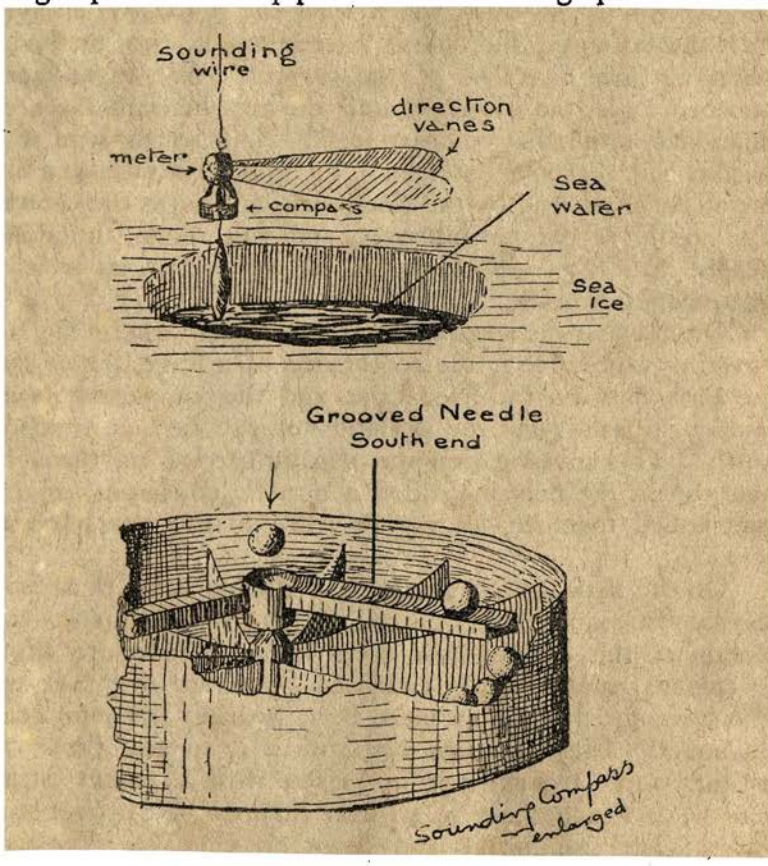
In the port after-cabin are held the mysterious consultations of the officers of the Eastern Party. It is rumoured that there is a capacious private store in which all unclaimed articles are deposited for their future benefit. But this is only a base libel, aroused by the orderly character of Lieutenant Campbell. Priestley's previous experience is invaluable to the party. In the foc'sle Major Oates and Dr. Atkinson are examining the ponies, all of which are doing very well since the gale. Ponting selects choice compositions for pictorial photography, and commandeers idle officers to lend life to his studies by disposing themselves gracefully in the rigging. Debenham is profiting by Dr. Wilson's hints, and fulfilling his duties as honorary illustrator to the iceberg watch. Wright is still engaged on his huge ice microscope, endeavouring to cut down its ample proportions in readiness for our forthcoming western expedition. From the "Nursery" come the dulcet tones of the pianola, under the soulful touch of Lieutenant Rennick. The other officers are on watch, or perhaps enjoying a well-earned snooze in their respective cabins.

There are many features of interest which we can study during our enforced stay in the pack, in addition to the fauna. We have been able to obtain some half-dozen soundings in this portion of the Southern Ocean, and to make current

D. LILLIE—SHIP'S BIOLOGIST.
With Ophiuroidea from the dredge.

THE NORTHERN FRINGE OF THE PACK ICE, SHOWING THE WAKE OF THE SHIP THROUGH OPEN PACK, DEC. 10, 1910.
[See p. 58.

measurements. Great also have been the achievements in ski-running under Lieutenant Gran's tuition. The sounding apparatus consists of an iron pipe about a foot long containing a valve. This is connected to several miles of piano wire, and an iron weight carries the apparatus to the bottom, where it is released by a trigger so as to involve less labour in hauling up the valve-pipe. A small telegraph winch is



mounted on the port bow, and here the afterguard in batches of six have spent many profitable hours winding up miles of piano wire. Samples of the bottom are caught by the valve. Reversing thermometers and water-bottles, bringing up samples of water for analysis, all these are hung at intervals along the wire. On almost every occasion small fragments of volcanic ash have been collected, which seems to imply that this forms

a constant deposit. There are many small foraminifera shells (*Orbulina*) in the mud, which can be made out under the microscope.

The current-meter is a more unusual instrument, and is a Norwegian invention. It consists of a small fan-wheel arrangement, which is rotated by the current, and which actuates some clockwork recording the velocity. At the back project two large vanes, which turn the apparatus always to face the current. But most interesting is the method of obtaining the direction of the current. A compass-box is attached under the fan-wheel, and the area beneath the needle is divided into radial compartments. The south arm of the needle has a groove cut along its upper surface, and little metal balls, released by the clockwork, fall on to the centre of the needle at regular intervals, and run down the sloping needle into that one of the radial compartments which is immediately beneath.

On drawing the apparatus to the surface—where the large directing vanes give it the appearance of a huge dragon fly—the angle between the fixed vanes and the compartments containing the balls gives the deviation of the current from true north. This investigation was usually carried on through a hole cut in the floe alongside; a derrick, consisting of three oars lashed together, leading the wire to the winch on the ship.

On the 14th we tied alongside a floe of some three acres. Another ice quarry was opened up for water, but on completion of this duty almost every one proceeded to ski, or in current parlance (à la Gran) to go "mit dee shee op." We have for a week or more been wearing the comfortable ski-boots. They are furnished with a deep and broad sole around which the ski-strap is locked with a patent latchet. The toe is rigidly fixed in an iron clamp with an over-strap, but the heel can lift up and down off the ski. I suppose every one has a general idea of the ski (which word is pronounced *shee*). The chief requisite is that the wood shall be strong and straight in grain. Our "Chips" has made some on board which answer very well. The others were brought from Norway by Lieutenant Gran. They were smaller and simpler as regards straps than the New Zealand and Kosciusko samples.

We learned from Gran that a knock-kneed man has the advantage in ski-ing; at any rate we had to keep our knees together to counteract a tendency of the ski to spread. Gran flapped along like an Atalanta on pattens, but beginners need to go more cautiously, and not lift the ski at all. We made a course all round the floe about three-quarters of a mile in length, and several of us did five miles or so. It would have amazed our friends at home to have seen us far south of the Antarctic circle spending an hour on the ice clothed in nothing but a thin vest and breeches. In this garb we were pleasantly cool, but after returning to the ship a couple of thick jerseys and a coat were soon donned. When I was half round the third lap on the further side of the floe I heard a loud snorting, and looked into the water to see a whale just sinking out of sight about fifty feet away. Occasionally a seal would put his head on the edge of the floe, and blow through his nostrils at us before sinking gracefully beneath the ice.

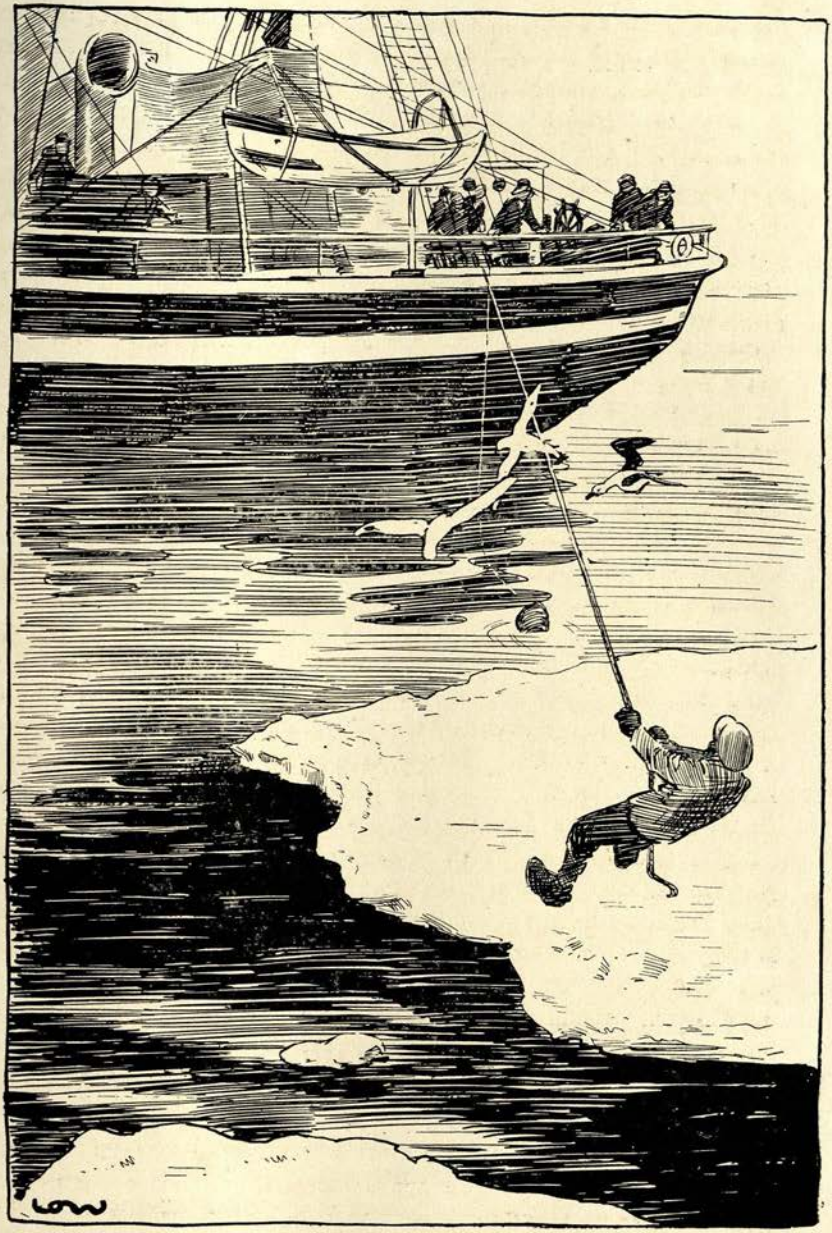
Sometimes we were not so fortunate in our ski-ing surface. At our next block the floe was very mushy, and water immediately oozed into a hole scraped an inch or two below the surface. This did not matter much as far as ski-running went; I mean it was possible to cross it. But if one came a "cropper," as was but too usual in our party of novices, the sudden shock and decrease in the bearing surface resulted in rather dangerous cracks, and in a dolorous soaking. Towards evening the surfaces often hardened appreciably. Of course the best section of ski-work—that of coasting down slopes—was impossible on the floes. We tried to coast down little hummocks, but I gave up this pastime after smashing my ski-stick in a crevice covered with snow.

Meares had out the dog-sledges on the large floe, and harnessed eight of the dogs to the single rope-trace. They pulled vigorously, and were guided solely by voice, "ka" meaning "to the right," and "chui" "to the left." An unlooked-for happening, however, spoilt their good record. Cherry-Gerrard had caught two penguins, and was carrying them to the ship, when the dogs caught sight of him, and bolted for the penguins. Then might have been seen a noble panorama: Dr. Wilson hanging on the rope ladder over the deep water to receive the penguins, Cherry fleeing for his life, the dogs tearing after him at their top speed, in spite of the

efforts of Meares on the rocking sledge; our honoured commander roughly upset as he tried to stop the procession, and Gran flapping along on his ski to be in at the death.

On the 18th we reached some fairly open water. I went on iceberg duty at 8 p.m. as usual. There was nothing to report until nine, when we approached thicker pack. We had been moving at what seemed lightning speed after our week's wait. Gran and I were watching a floe bumped by the ship. The nearer half sank under the blow, and then rose as we passed. In the middle of the floe was something kicking violently. We yelled out, "Fish oh!" and as we have not been able to catch any in Antarctica so far, this small specimen, less than a foot long, roused much excitement. It was of slaty-blue colour, and had been caught by the uprising floe. Captain Scott ordered the ship to be sent astern, and the whole expedition returned about a hundred yards to catch that fish. So did two snowy petrels and a skua gull. Then might have been seen eminent explorers, scientists, and sailor-men yelling themselves hoarse to scare away the birds of prey! We backed on to the floe, and as I was about the best situated, I jumped down to the ice and secured the fish, just as the birds were deciding that the unseemly clamour could not hurt them. A leather bucket on a line received the fish, but unfortunately the floe started drifting away, and soon was held only by my pull on the bucket-line. It was rather a comical situation, for if I let go the fish would probably get adrift, and if they let go I should get adrift! However, I had to let the bucket go, and luckily—though it filled with water—the fish did not have time to jump out. Then a heavy rope drew the floe to the ship's side across some twenty feet of water—no easy job, since the floe was twenty-five feet wide, and there was nothing to which the rope could be tied. The fish turned out to be a blenny, allied to the climbing perch of the Queensland coast. Whether it is new or not is a question still to be decided.

We passed some very interesting icebergs during the next few days (18–20th). I remember especially one long berg on the eastern horizon, on which the setting sun was shining. It must have been a tremendous length, and looked like a golden scimitar flung across a dead white plain. Even our helmsman noticed it, and said, "A white-back, sorr; it



CATCHING THE FISH IN THE PACK.

From a drawing by D. Low.

looked like the lights of a great city." The pack was very heavy hereabouts, but we made some progress along lanes of more or less open water. A berg along which we skirted, instead of presenting clean-cut vertical cliffs, was corrugated on its sides, and very rugged on its upper surface. Probably it was derived from a glacier. A stage of planks was thrust out from the starboard bow, and on this Ponting perched his cinematograph, and photographed our progress through the heavy pack.

Later in the day every one was called up on deck to see the magnificent avenue we were traversing. Each side of the lane was bounded by immense sheets of iceberg, with low cliffs, fifteen feet high, so strikingly vertical that they might have been cut to a set square. The bergs were six in number, and were probably fragments of one huge slab of the Great Barrier, over a square mile in extent, which had been driven north before the winter gales. (We novices did not appreciate the danger involved if these bergs happened to press together, but our leaders had an anxious time here.)

An Emperor penguin was sitting on one of the floes near the low bergs, and we tried to stalk him in the *Terra Nova*. Surely with no other game in the world could one manœuvre for half an hour in full view of the victim with some hope of success. However, the Emperor did not wait quite long enough, but dived just when the ship had backed to his floe, which looks as if he had a sense of humour.

Dr. Wilson carefully preserved the contents of the stomachs of the penguins. Among biological specimens, such as shrimps and the like, he found about a dozen small pebbles. These, when carefully examined with a lens, were readily identifiable by the geologists. There were three eruptive rocks represented—a dark basalt ash, a denser stuff with little augite crystals, and, most abundant, a hard felspar porphyry, with numerous little twin felspar crystals. What geologist would have expected to have such a fine collection of Antarctic rocks carried to him in mid-ocean?

We were now collecting penguins also—for our Christmas dinner. Three were seen alongside on a somewhat thin floe, and Dr. Wilson gallantly undertook to augment our larder. Meanwhile the afterguard ranged themselves on the poop, and

sang "Rings on her Fingers and Bells on her Toes," which often has a calming effect on the penguins.

Perhaps the choir was not in unison; anyhow, the penguins waddled off, and "Dr. Bill" followed hot-foot. They lay down on their white shirt-fronts, and propelled themselves vigorously with their strong hind legs. ("Hind" seems necessary, for in this position the flippers resemble legs more than wings.) "Dr. Bill" came a cropper, and involuntarily copied their movements, and then, seeing they were less alarmed when he was prone on the floe, he crawled towards them, singing winsomely the while. When a quarter of a mile from the ship, a final leap, "swift as the striking cobra," landed him on them, and he grabbed one. His further efforts, hampered by a lusty penguin, were not successful, and he returned reluctantly to his comrades, to find them exhausted with laughing at his comical career all over the floe. Our chief penguin-charmer (Meares) declares that he can drive away any penguin by singing "God save," as he calls it. But this is a *post hoc, propter hoc* statement, for we do not permit him to attempt this dangerous experiment until they show signs of melting away.

Christmas being imminent, we felt it necessary to add to our scanty penguin provender. A flock of nine were seen about six hundred yards off, and four of us, armed with a shot-gun and mauser, lowered the pram (a dinghy with a long upturned prow) over the side and headed for the penguins.

Six hundred yards does not seem far, but it took a long time to traverse. There was just about room to turn round in the water alongside the *Terra Nova*. Then a choked lane led by a zigzag course to a large sheet of water away to the west. The floes were 100 feet across and the spaces between filled with spongy floe and by chunks of ice, which were readily removable by the *Terra Nova*, but which we could hardly move. However, by dint of pushing and prodding and hauling the pram over ice-foot we got to the open water and then pulled over to the penguins. They were needed for food, else it seemed cruel to drift down upon them singing our siren song. Five fell at the first volley and four moved off rapidly to the north. Again we skirted the floe and bagged three more. The fourth was shot also but slipped into a hole, and when we cautiously tramped over a floe—

prodding in front with an oar—we found no sign of the bird but the reddened snow. However, eight penguins was a fair bag, and we returned toward the ship. We had had so much trouble rubbing our way through zig-zag gaps in the floes that we ran the pram on to the larger floe near the ship and hauled her most of the way. It was somewhat unpleasant to slip in almost to one's waist in mushy floe, as happened to two of the party, but otherwise we had no misadventure. A close inspection of the penguins showed that their surprised appearance in the photographs is not due to abnormally wide-open eyes, but to the presence of a colourless eyelid completely surrounding the eye.

Although we made practically no progress south in the days around Christmas, yet we did not allow this to affect our festivities. Owing to the coincidence that Christmas Eve and Boxing Day were the birthdays of two members of the after-guard, we celebrated them also with appropriate ceremonial. We toasted the victim at dinner, and after much bashful hesitation he made a satisfactory speech. Then he was "chaired" twice round the mess (only, as there were no chairs, this consisted in passing him from man to man shoulder high). He was next lifted up over the main beam (crossing the wardroom) and passed down again and then left in peace. Songs for two hours and a scrimmage in the "nursery" (which was dignified by the name of Lancers !) completed the evening.

On Christmas morning we started off well by pumping for half an hour. When the furnaces are out, this is done by hand; but she is making very little water now. Sixteen of the afterguard, led by Priestley, singing "Ranzo, Boys, Ranzo," soon cause the valves to give the cheery chuckles which announce that air is mixing with the water and that the bilge is nearly dry. Then with a will to breakfast. After the meal was cleared away, our "pack-ice" pattern tablecloth was replaced by one of noble blue, and we decorated the wardroom for Christmas. All the sledge-flags were brought out and hung around the walls outside the cabins of their owners, as in mediæval times. There was great discussion as to the proper heraldic description of our flags, but the Encyclopædia on board showed nothing like them in its article on heraldry. Captain Scott's has the white

square with a red cross of St. George near the staff, and the other portion divided longitudinally into yellow and blue. In the middle is his crest of a stag's head, with the motto, "Ready, aye, Ready!"

The service was read by Captain Scott and differed little from the ordinary Church of England service, except by the insertion of two special collects. Then some gifts of tobacco and sweets were distributed to all on board. They were presented by the Dunedin Seamen's Mission and were much appreciated. Many of the after-guard unearthed treasures "not to be opened until Christmas Day." Some of these were of an edible nature, and were seen but for a short space before they passed away. I think the most noticeable feature of the dinner was the white damask tablecloth. It supported turtle soup, penguin stew, roast beef, mince pies, and plum-pudding. We enjoyed the meal thoroughly, but, then, that is always the case. Songs—some written for the occasion—stories, chanties, and banjo music filled in the evening.

Microscopic life simply swarms in these Polar seas, to an infinitely greater extent than in the warm waters of the tropics, though one would be inclined to the opposite belief. The economic research of German and Norwegian biologists has shown that there is almost as much protoplasm—the basis of all life tissues—per acre of ocean as there is in a well-cultivated crop on land. Most of this floats near the surface in the form of minute plants (diatoms) and minute infusoria, foraminifera, and copepods (which are animals). As a result, the struggle for existence is probably much more strenuous among these floating organisms (plankton) than it is on land. What may be termed the cycle of life—recalling the Indian idea of transmigration—is very evident in the pack ice. At the basis here, as on land, are plants; for they alone can convert inorganic material into protoplasm. Almost every floe in its lower layers is stained yellow from the presence of millions of little organisms (such as *Corethron*) belonging to the Diatom family. Our biologist is examining some specimens through his microscope, and if we look down we see some transparent rods with indications of granular matter at intervals. These are magnified some thousand diameters, so that it can be realised how many are necessary to colour the ice to a deep yellow. Hovering all about the floes, waiting

for the diatoms to thaw out, are the smallest marine animals, of which the infusoria give rise to the phosphorescence seen in many seas, and the foraminifera to that beautiful calcareous deposit known to every one by the euphonious title of "globigerina ooze." Feeding on these are animals of a much higher order (crustacea, in fact, allied to shrimps), and known as Copepods and Schizopods. Commonest of all is the large schizopod *Euphausia*.

These fellows are so big that we can see them swimming around the floes. They may grow to a length of two inches, and but for their split feet—each branching into two, as the name Schizopod suggests—look very like pale shrimps. They are the mainstay of the better-known animals—the penguins, seals, and whales. Ever ready to attack the three latter is the killer whale, a ferocious dolphin, which drives the seals and penguins to take refuge on the floes. Here they fall easy victims to man, for they have not yet learnt to expect any enemy except in the water. Since the killers are credited with attempts to shake some of Shackleton's men off a floe into the water, it appears as if *homo sapiens* would be relished by these same shark-like mammals. Undoubtedly, if man reigns on land *Orca gladiator* is lord of the Antarctic seas.

Towards the southern limits of the pack the "iceberg watch" was not very strenuous, and I fear me I played truant at frequent intervals. One expedition down to the cosy engine-room resulted in a glorious hot bath, which is quite sufficiently a rarity to be chronicled. The second engineer warmed a bucket of water by the Fijian method of dropping a red-hot lump of fire-bar therein. This quiet officer was he who probably experienced the most thrilling moment in Antarctica. With Petty Officer Evans he accompanied Scott on his western expedition, and on the Ferrar Glacier saw his two companions disappear together in a bottomless crevasse. Captain Scott has told how he managed to climb up the trace, but I can imagine Lashley's despair as he grimly held back the sledge, and thought of the dreadful solitary march that most probably confronted him. Evans also has returned to his old leader's flag, and is in charge of the transport material. Cheetham and Paton have made five voyages already across the seas, though I do not anticipate that they will join the shore party. With the Eastern Expedition (to King Edward the

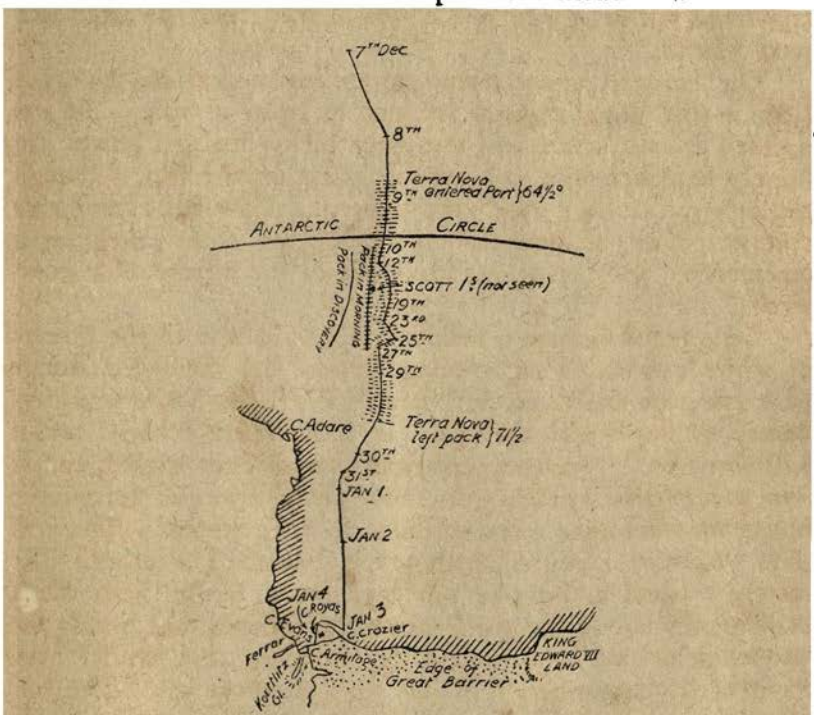
Seventh Land) goes Abbott, a naval man and a champion wrestler. Several other members of the crew will join us in Antarctica, so that the *Terra Nova* will seem very empty on her return voyage. She will be under the command of Lieutenant Pennell, who will be accompanied by Lieutenants Rennick and Bruce, and by Mr. Drake. They will have the wardroom—now occupied by twenty-four officers—to themselves, and are trying to impress *nous autres* with the comforts combined with elegance which will characterise the after-deck next March.

On the 27th we were drifting aimlessly in thick pack, but later in the day the floes seemed to open a little. It was decided to raise steam and trust our luck—for sail power had merely kept her nose to a big floe most of the time—though the prospect did not look very hopeful. Towards evening we met examples of over-ridden floes, two thin cakes being recemented, and this seemed to indicate the effects of a recent swell.

Lieutenant Gran is a believer in a mild way in the powers of white magic. That evening he saw the discarded Bridge pack lying on the table, and said, "We'll see how many days before we finish with this ice. If I draw out a black card it will show us." So he straightway turned over a card, and it was the two of spades. As you shall hear in forty-eight hours we were once more entering on open water! The next day we were favoured with most beautiful weather. We slowly pushed and broke our way through the floes which occasionally shook the good ship to her centre, and hitting the propeller caused a succession of shudders that would have "shivered the timbers" of any less stout vessel. The sun shone with almost a tropic heat—there was no wind and a temperature of 37° brought all the afterguard out on the poop to soak in the sunbeams. Every available square inch was occupied by basking humanity, and this unusual phase of our "strenuous life" formed the subject of several photographs.

Until one has been blockaded for three weeks by some such unexpected obstacle as this mighty width of pack, it is difficult to realise how closely we scanned its texture for any hint of its boundary. Towards the evening of the 29th we began to hope that the pack was showing similar features to those we met with on entering. Very beautiful were some of

the piled-up pressure blocks. I remember one of the nature of a "glacier-table." A flat-domed slab some three feet across, was perched on a slender support above the floe. Pendant from the table were numerous long icicles, consequent on the warm weather. The under surface of the table, owing to repeated reflection, was a beautiful ultramarine, which was seen through the curtain of icicles, and the whole structure reminded me of one of those resplendent medusæ which float



Course of *Terra Nova* through the Antarctic pack, as far as Cape Evans, from December 7, 1910, to January 4, 1911.

placidly on the sea, with their tentacles hanging from the fringe of the "umbrella." Hereabouts the floe became thinner and more uniform. It was broken into wide sub-angular surfaces, with vertical sides, as when a sheet of "short-bread" is broken for consumption. At nine o'clock we entered a wide lane where the placid water we had encountered hitherto was replaced by an area of short choppy waves. Then an area of "pancake," with rounded outline and upturned

edges, and, finally, just at midnight we crossed several east-west belts of "brash-ice," and at long length entered the open Ross Sea.

The *Morning* and the *Discovery* had each entered the pack in latitude 66½°, and emerged in 69½°. Thus they crossed three degrees of latitude, or a little over two hundred statute miles. We entered it in 64½° and left it behind in 71½°, which is seven degrees or almost five hundred miles. Moreover, the width of the pack has this in common with the height of a range of mountains, that the difficulties increase in a much greater degree than *direct* proportion as these factors grow large. For a great width of pack implies older and thicker floes in the centre; with an absence of cracks, since the swell cannot penetrate this region. Four miles of a narrow pack may be traversed in an hour, but the same distance in the middle of the belt often took us more than twenty-four hours.

CHAPTER V

THROUGH THE ROSS SEA

MIDNIGHT on the 29th marked our breaking through the pack, and thence we sailed southward and slightly westward, without further trouble from the ice. In fact, it was a help, for we encountered half a gale from the south on the 31st and hove to under the shelter of a drifting belt of pack. This was necessary for the sake of the weakened ponies. Advantage was taken of the halt to put down soundings. Bottom was reached at 187 fathoms, whereas the day before it had been 1111 fathoms or 5500 feet deeper! We hauled up some small pebbles of eruptive rock coated with polyzoa—a low form of life which was absent on the rocks from the deep water.

Late in the evening of the last day of the year the officer of the watch reported "Land in sight." On the starboard bow was a clouded horizon, and there, apparently far above the sea line, in a belt of thinner clouds extended a range of mountains in a vast panorama. There were two widely separated peaks rising in solitary splendour, and akin in form to the Matterhorn; but even grander owing to the clothing of snow from top to bottom. These were Mounts Sabine and Monteagle, each about 10,000 feet high, with their slopes washed by the waters of Ross Sea. They lie well to the south of Cape Adare, where Borchgrevinck spent the first winter in the Antarctic.

An hour or two later we kept up the good old ceremony of ushering in the New Year. At the proper time Lieut. Evans performed on the steam siren, and others of us, with handbells and other weapons of offence, awakened the sleeping afterguard. As a grand finale, a march was played on the

pianola, after which we turned in with a pleasing consciousness of duties nobly done.

New Year's Day was most beautiful weather. Some portion of it was occupied in swinging ship to correct the compasses. In a chart plotted to show the magnetic variation this region is of great interest. For the last few days every degree of southing has approximately led to a change of one degree in the magnetic variation. Thus on entering the pack the variation from north was 40° E.; on leaving it was 60°, while at Ross Island it has increased to 150°. The magnetic pole—to which the S. end of the compass needle points—lies inland some 200 miles from Mount Sabine. On the line joining the magnetic to the south pole the compass readings are completely reversed. Captain Scott, on his western journey, crossed this line, and when he sent back a party of men, told them to find their course *due east* by following exactly the path indicated by *west* on the compass.

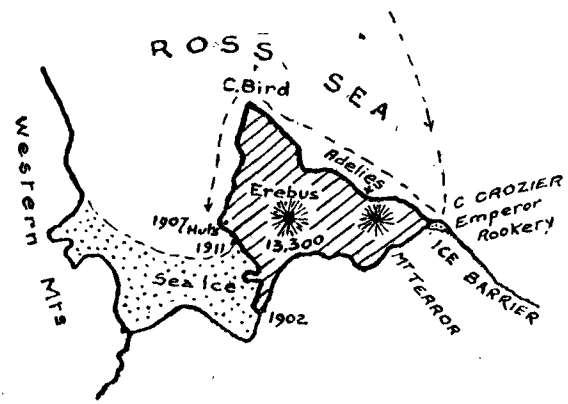
During these few days every one is much occupied with letters home. Special stamps—surcharged VICTORIA LAND—have been issued to us, but as their number is limited, I fancy few of them will be exposed to the tender mercies of the post offices of the world. On the last expedition many of the letters bearing Antarctic stamps went astray, so that on this occasion two envelopes are being used by those who desire to send home officially obliterated stamps. The talents of the afterguard as regards letter-writing vary considerably. One member is sending off nearly a hundred postcards and letters. Another collected a few important dates from other people's diaries—to lend an air of exactitude to his epistle, he explained—and then proceeded to send off one letter of no great length.

If it were possible, Captain Scott proposed to make Cape Crozier his headquarters. In some respects this was superior to other positions. It was new ground, except for a hasty survey; it was near the Emperor Penguin settlement. More important, it was permanently connected with the Great Barrier, whereas Cape Royds is isolated from the south by impassable cliffs and glaciers in summer.

A *sine qua non*, however, was a firm ice-foot, or sea-ice platform, on which to disembark the heavy motor-sledges and the ponies. The 3rd of January was a day replete with

interest. At noon we had approached near enough to Mount Terror to see the details of its surface. Erebus lay twenty miles to the west, and was shrouded in clouds and somewhat behind Terror. As we steamed in toward Cape Crozier we could see the great Ice Barrier extending indefinitely to the east. Owing to the numerous fragments of the Barrier we had met to northward, and to the pictures we had studied, this giant wall seemed like a familiar old friend. As one of the men remarked, we seemed to have been seeing it all our lives! At this point it was about sixty feet high, and gave rise to a curious meteorological effect.

In the far east, where the lessening ribbon of the ice front reached the horizon, there was a distinct difference in the sky to north and south respectively. To the north it was a dark grey, with heavy cumulus, but in a definite arc over the Barrier



Coasting Ross Island, January, 1911.

this was changed to pearly grey, and the clouds were almost white. This was, of course, a gigantic form of ice-blink, but I saw nothing approaching it in size or intensity in our passage through the pack.

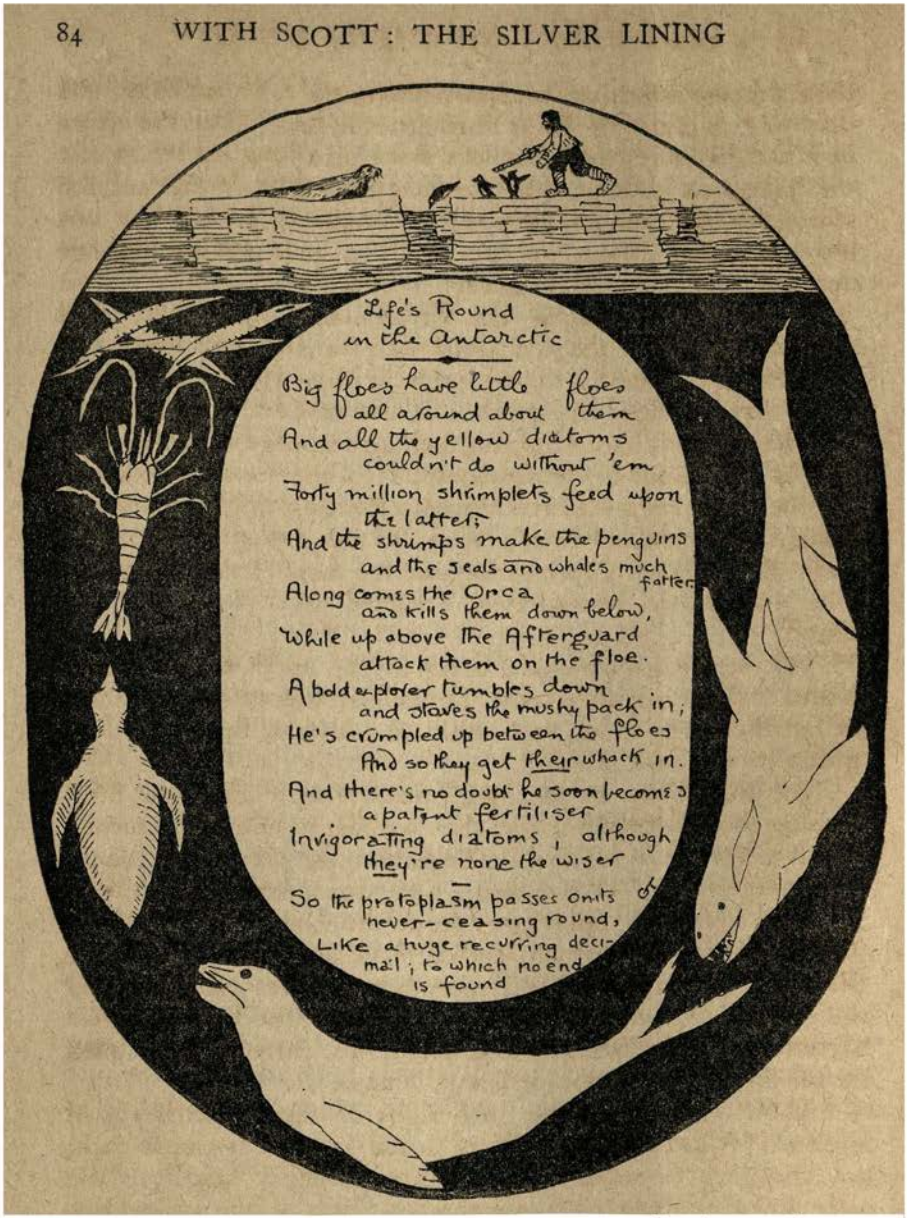
Near at hand were bands of brash ice, forming a sort of miniature pack just under the Great Barrier. On this bobbing and rotating surface sported flocks of penguins, performing marvellous feats of equilibrium, and nowise disturbed by the huge bulk of the ship towering above them. The Barrier front is deeply undercut by the waves at the water-level, and

small berglets were constantly dropping off above this line of weakness. Probably they give rise to the broken masses cemented to floes which we met in the pack; while the large bergs are pieces broken off from the *whole* face of the Barrier. From top to bottom the Barrier would here be about 250 feet deep, I expect.

By this time we had approached as near to Cape Crozier as the swell would allow. In the angle between the Barrier and the rocky cliffs buttressing Mount Terror were piled up masses of pressure ice for some distance back from the sea. The cliffs of dark lava were 250 feet above the water, and were actually overhanging in places. Further west, again, the shore line consisted of some low bluffs separating beaches of considerable extent. Behind these beaches, the rock, instead of being black, was a light brown or buff colour for a distance of a mile along the water's edge, and perhaps a quarter of a mile inland. It was difficult to realize that this brown area was a guano deposit, resulting from the presence of a vast colony of penguins. Through the glasses we could see vast regiments of them, extending far up the hill slopes and making their way across patches of snow from one rocky surface to another. Quite separate from the main rookery were two little exclusive colonies, though why they should move away from their fellows, and so far from the sea, is difficult to explain. In the background towered Mount Terror, 10,000 feet high, his summit occasionally appearing through a break in the clouds.

Captain Scott decided to prospect for a landing-place in a whaleboat, so a party set off to cover the intervening half mile. Bits of floe, that seemed insignificant in the *Terra Nova*, gave the whaleboat a nasty jar, and the swell quite prohibited our making a landing at any point. We made for the lowest place in the pressure ice. Here a floe had been forced up to form a deep sea cave, and along one side was a pathway used by the Emperor penguins. Hanging head downwards from the roof of the cave were two dead penguins, which had been caught in the pressure. Awaiting us were two Emperors, one full-grown, and the other a lusty chick the size of a duck, and covered with grey down. It marched off in a stately fashion without the ludicrous wobbles of the Adelies; and so escaped the clutches of Dr. Wilson, who was eager for its

scalp as soon as he saw its plumage. We then rowed west for half a mile under the lava cliffs. Some lenticular patches of white material among the dark basalt reminded me of the alternating layers of snow and lava seen in a volcanic island in the South Pacific. But this white material was not snow, but a basic ash from which all the iron (the colouring material in Vulcan's workshop) had been bleached out. We felt rain falling, and looked up to see that we were right under the water from the melting snows of Terror, which dropped 250 feet from the crumbling lavas. Lest the latter should also fall on us, we moved seaward. A magnificent series of basalt columns appeared before us. They were long, narrow, hexagonal rods rather than columns, curved and interlocked, and about a hundred feet long. For a hundred yards or more, the appearance of this cliff face reminded me of the fracture of a coarsely crystalline piece of cast iron. I have not heard of a parallel case of columnar basalt. There was no hope of landing under these cliffs, so we made for the ship, and soon put off to the penguin rookeries, where some sea-ice might be expected to remain. After passing some stranded bergs, we came abreast of the penguin colonies, and the sea was perfectly full of the birds cruising about in search of their shrimp-like food. I have never seen seas so teeming with life. The explanation is that these polar waters are free from the bacteria which break up protoplasm and so render it to some extent useless for food. The cold waters act as a kind of cold storage, and supply unlimited food material for higher organisms in the form of algæ and protozoa, which quickly vanish after death in warmer regions. At the other end of the scale of life in the Antarctic are the warm-blooded killer-whales (*orca*), of which we saw a party of three busy gobbling up penguins. The cycle involved has been described by one of the scientists on board in a rhyme, which is descriptive, if not poetical :—


Life's Round
in the Antarctic
Big floes have little floes
all around about them
And all the yellow diatoms
couldn't do without 'em
Forty million shrimplets feed upon
the latter;
And the shrimps make the penguins
and the seals and whales much
fatter.
Along comes the Orca
and kills them down below,
While up above the Afterguard
attack them on the floe.
A bold explorer tumbles down
and staves the mushy pack in;
He's crumpled up between the floes
And so they get their whack in.
And there's no doubt he soon becomes
a patent fertiliser
Invigorating diatoms, although
they're none the wiser
So the protoplasm passes on its
never-ceasing round,
Like a huge recurring deci-
mal; to which no end
is found

(As will be seen later, the human element in the cycle was nearly supplied!)

One never sees the penguins swimming on the surface. Occasionally a snake-like head pops up and looks around for a few seconds, but usually they are swimming rapidly with

their flippers a foot or two below the surface, or imitating the dolphins in curving leaps through the air. On the shore near the rookeries the snow was worn into long gutters where the penguins promenaded to and fro. The winds are too strong for any economic deposit of guano to arise. We saw brown patches driven by the wind on to a snow bluff five hundred feet above the rookery.

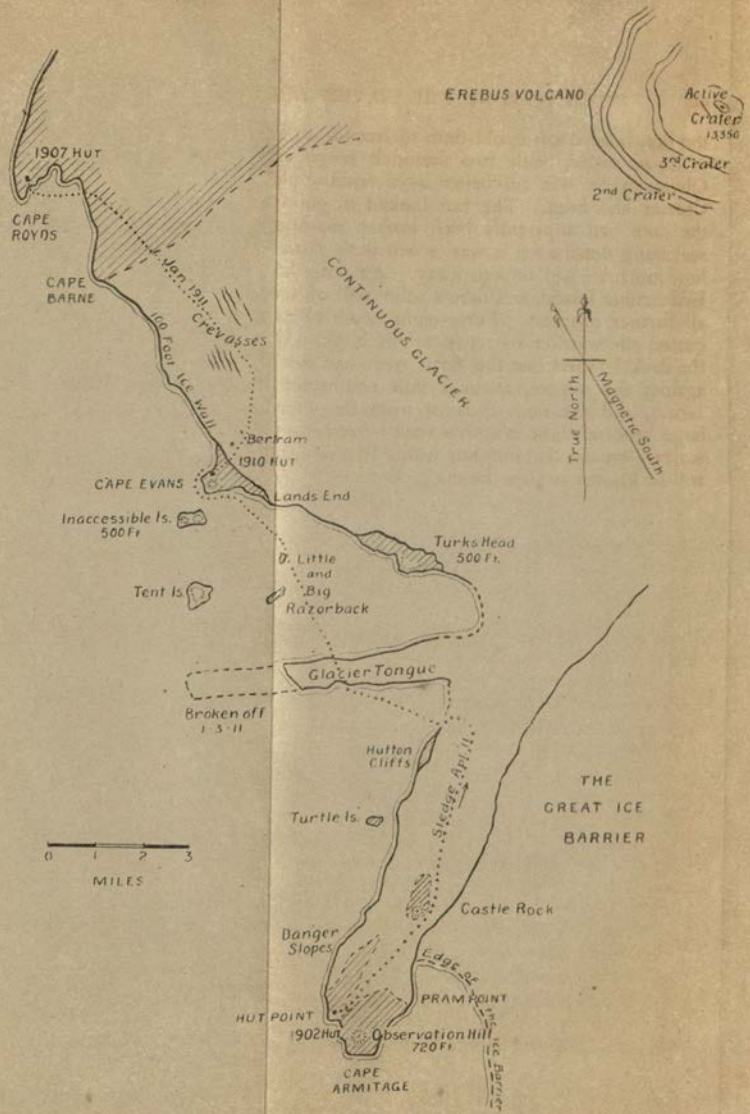
About 6 p.m. on the 3rd Erebus came into sight. We approached it from the north-east—an unusual direction—and so, perhaps, obtained a more comprehensive view of the outer crater than previous observers. It is a wonderful "Somma" ring, like that of Vesuvius, and being composed of dark steep rock, it stands out in strong contrast to the inner white cone and the outer snow-covered slopes. Ponting got a fine photograph of it, which will be of interest to vulcanologists. Having given up all idea of wintering on the north-east quarter of Ross Island, we immediately steamed west to McMurdo Sound.

We were engaged on a survey of the north coast of Ross Island. Bowers with sextant, Pennell at the compass, Campbell at the range-finder, each with an assistant, formed a busy group on the ice-house.

All that night we steamed steadily west to Cape Bird, passing Beaufort Island on the starboard, and then turned south again to Cape Royds. Beaufort Isle was the scene of an exploit of one of our seamen (Paton), who was shut in by pack some five miles away from the island in the whaler *Morning*. He and a mate broke leave to try and reach the isle across the floes, but had to return without accomplishing their wish. On his return to civilization Paton found he had become a proud father. The child was christened Beaufort Paton on the suggestion of Lieut. Evans.

About 5 a.m. we came into sight of the western face of Erebus. McMurdo Sound was closed in here by loose pack, but the ship threaded her way through fairly readily. We were keenly interested to see the condition of the ice at Cape Royds, and two of our afterguard (Priestley and Day) have a personal interest in the headquarters of Shackleton's expedition. Soon after the queer volcanic knob on the end of Cape Barne hove in view we sighted the meteorological screen, and immediately afterwards the hut of the 1907 expedition. But

the bay, instead of its old-time surface of sea-ice, was a sheet of open water, with two stranded bergs in one corner. Obviously it was no better as a landing-place than Cape Crozier had been. The hut looked in good order, though the door had apparently been broken in, but we could not see many details, for it was essential to push south and see how much ice had broken away. An hour later we reached Inaccessible Island, and here a solid wall of sea-ice prevented all further progress. Forty-eight hours of coast observation caused one watcher to retire to his bunk. On returning to the deck I found that the *Terra Nova* had come to a standstill against the sea-ice, about a mile south-east of Inaccessible Island, and the same distance from the shore. Here on a large area of dark eruptive rock—freed from snow at this season—we are building our hut. In the future the locality will be known as Cape Evans.



MAP OF THE COAST FROM CAPE ROYDS TO HUT POINT.

CHAPTER VI

MAKING WINTER QUARTERS AT CAPE EVANS

On the morning of the 4th we carried out hawsers, and put in ice anchors in the ice, over which so many journeys were to be made in the next fortnight. Captain Scott, Evans, and Dr. Wilson went off to choose a suitable site for the hut, and returned very pleased with their brief survey.

Let us look landward from the *Terra Nova*, and examine the locality where the expedition will spend some six months of the ensuing twelve. We are drawn close to the ice, which stands about eight inches above the sea, and some eighteen inches below water-level. It is variable in texture, that near the ship being rather mushy and honeycombed below—while several large cracks traverse it. Further away is a belt of clear hard ice, and then bands of snow-covered and clear ice for a mile or so, until the shore is reached. Here along the western slope of Erebus extends a belt of the dark volcanic rock, *kenyte*, and in consequence of the rapid heating of dark objects by the continuous sunshine, this is largely free from snow. Immediately at the shore-line is a belt of very soft ice, fantastically honeycombed, and threaded by streams of fresh water. Crossing a snow-bank, we rise slightly, and reach the kenyte gravel on which our hut and the head-quarters generally are placed. Walking along this gravel slope, we come to a flowing stream, falling over a little water-fall—a rarity, as may be imagined, in Antarctica. Moreover, this stream rises in quite a respectable lake—which, if not large enough for a regatta, at all events affords good exercise in chasing the skua gulls, which have been attracted by the open water. Continuing eastward, the steeper lower slopes of Erebus are reached. The lower portions are of the same dark eruptive rock; but a few hundred feet from the sea-

level these are covered by a pall of snow, which extends almost uninterruptedly to the summit of Erebus. The slope steepens considerably at an elevation of some five thousand feet, and when the top is clouded over, the lower portion is not unlike the base of Fujiyama in Japan. On a clear day the steam-cloud capping Erebus is very obvious. Usually it is seen drifting to the south from a sharp vertical column arising directly above the crater. Sometimes, however, the steam-cloud spreads out fairly symmetrically, and on one occasion it simulated a gigantic cedar-tree, with a central trunk and spreading branches. To the south are two stranded bergs, which I shall describe in detail later. As a background to these dazzling white pyramids is the sombre ridge of Inaccessible Island, which some of us before long—in spite of its name—managed to conquer. To the north-east is the cliff-like edge of the Cape Barne glacier, reaching almost to the curious dark erratic outline of Cape Royds. Fifty miles away to the west, across the sound, the wonderful glacial valleys of the western mountains are seen veiled in clouds.

Now began a strenuous time for all on board. It was necessary to get the heavy cargo off the ship while the floe remained firm. Though the weather was excellent there was no telling when a heavy wind would send all the sea ice into Ross Sea. Gang-planks were run out, and the wildly excited dogs pulled, pushed, and tumbled into the hands of men on the ice. Then they went at a gallop over mushy ice to the bow ice-anchor chain; there they were tethered at intervals of a foot or so. We had not been at work long when inquisitive visitors turned up. These were the Adelie penguins, who waddled eagerly forward, and promenaded about, with their heads bent on one side in a very critical fashion. Unfortunately the dogs were as keenly interested in them, and simultaneously twenty of them rushed at the nearest penguin. A scene of wild confusion ensued. The heavy cable was jerked about so violently that the end dogs were lifted several feet into the air and hung there a moment suspended by their chains. Whips, yells, and curses were of no avail until the miserable bird had been torn limb from limb. For some hours one man had to be on the watch to warn off trespassers and prevent penguin suicide.

The ponies, with one exception, were much less trouble,

SURVEYING THE NORTH COAST OF ROSS ISLAND FROM THE *TERRA NOVA*, JAN. 3, 1911.

Photo looking aft from the foc'sle, showing six officers at the standard compass.

[See p. S5.

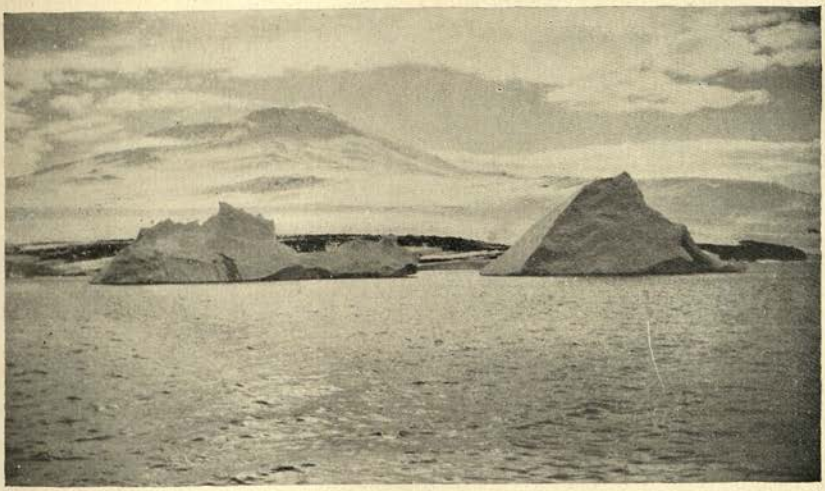


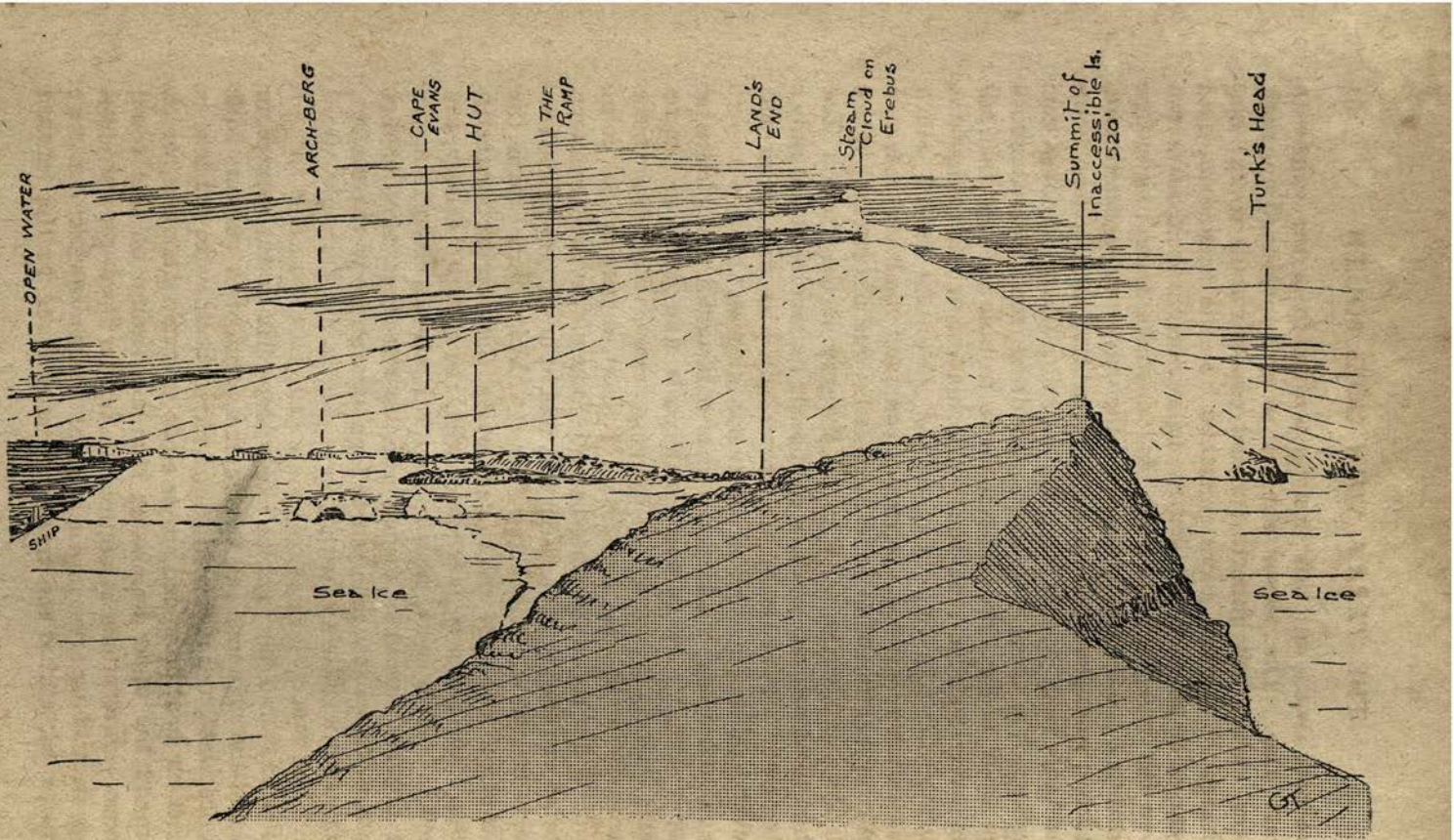
PHOTO FROM THE SHIP OF CAPE EVANS, JAN. 26, 1911.

The Tunnel Berg appears on the right. Behind is the dark line of the Ramp, and twelve miles away the cone of Erebus with a small steam cloud.

and were swung out in a box on a rope from the yard with great ease. The motor sledges were transhipped in their cases—which had hitherto formed efficient walls to the dog "hangar." Three ropes attached to the mainyard, and manned by ten men, enabled the case—weighing about a ton—to be swung up, outward, and downward on to the floe without a jar. The motors were then taken from their cases, and run further on to the floe, where Day and Nelson soon had them running. It was their buzzing which annoyed our high-spirited steed, "Hackenschmidt." He careered about the waist of the ship, and was more trouble to land than all the other sixteen. He continued his career of uselessness during the following busy season. Ponting found much material here for his cinematograph, and had the machine clicking merrily most of the forenoon. He has literally miles of films, and it is amusing to see the way he snips off a foot or so of an exposed film quite callously to develop it and judge the result. As he says, it only represents a second which will never be missed in a series of several minutes.

It was a large hauling job that confronted us. Material for a hut, 50 by 25 feet, with walls and roof of six or eight layers; sledging equipments, tents, etc., for thirty men; food for two years; fuel (chiefly a patent coal compound) for the same period; and fodder for the seventeen horses and for the dogs. All this had to be carried nearly two miles across the sea-ice on sledges. What now were the means of haulage? We had many and varied methods. Firstly, the motor sledges; secondly, the ponies; thirdly, the dogs; and fourthly, man power. Each has something in its favour. Speed of transit goes to the dogs, non-liability to accidents to the man-power; gross tonnage to the motors, and general efficiency (with decent specimens) I should award to the ponies.

The man-sledges got to work very early in the campaign. The sledges are nine and twelve feet long, with runners four inches wide, and upturned somewhat at both ends. There is a flexible bent prow, and six or eight vertical stanchions, which support the upper frame—as simple a design as one could devise. Everything is secured by leather lashings, the abutting ends being sewn into a sort of leather bucket. A rope loop projects from the front, but is fastened to the forward



Sketch from Inaccessible Island, showing the divided steam-cloud on Erebus, and the region around Cape Evans, looking north, 11 p.m., January 5, 1911.

stanchions, and not to the prow-piece, which serves chiefly to guide the sledge over hummocks of ice. A long rope with broad canvas belts (attached thereto by tributary ropes) constitutes the harness. When the load has been tied on by a piece of spun yarn, the leader steps into his belt, adjusts it over the hips, and, grasping his ski-sticks firmly, gives the word and plods on. Many a mile have we covered with bodies hanging forward over the belts, and our spiked boots and ski-sticks barely enabling us to pull the heavy load through a patch of snow-drift. But over moderately smooth sea ice it was quite easy for four men to pull a 1000 lbs. load on two sledges for a distance of a mile and a half in twenty-five minutes.

There were two dog teams in constant use, one driven by Meares, and the other by the Russian youth, Demetri. Their sledges are Siberian, and somewhat higher in the frame. The chief difference consists in a high hoop or arch of wood, which is placed two feet from the prow. By this the driver can twist his sledge around. He also carries an iron-pointed staff, to be used as a brake and also to guide the sledge to some extent. The dog teams consist of five dogs—one leader who is specially trained to obey commands (and sometimes scorns to pull), and two pairs of dogs toggled to a central rope much as in the man harness. These dog sledges career about in long sweeping curves, and the air resounds with barbaric cries of "Ky! Ky!" or "Chui! Chui!" while the ice screeches under the impact of the driver's pointed staff. His chief difficulty is to steer clear of penguins, for awful is the result if they sight an unfortunate bird! A dog team pulls the driver, so that 150 lbs. must be added to their load. Each dog pulls about one quarter that moved by a man, but at twice the speed.

The motor sledges took some little time, naturally enough, to swing into the ranks. They have fourteen horse-power motor-car engines, four cylinders, magneto ignition. Most people have seen illustrations of them, for they have been run in Norway and England previously, though designed for the expedition. The two axles bear two pairs of cog wheels about eighteen inches diameter. Around these run two endless bands—one on each side of the sledge—which carry flat square plates. These plates constitute the bearing surface,

and each plate is actually stationary on the ground until it comes under the rear cog wheel, when it is caught up and passed forward to the front cog-wheel. Hence the car runs on its own platform. The flat square plates grip the snow by diagonal bars. There is a large tool box in front of the engine, and a small elevated padded seat at the back. Otherwise no top hamper obscures the mechanism. When not in use the motor wears a huge quilted hood which keeps the cylinders from freezing.

In work two men are necessary. One drives from the seat, and another holds the end of a rope fastened to a projecting bowsprit. The latter is the helmsman, for at a pull sideways the sledge slews around without the expenditure of much effort. The camber on the plate belts also helps the turning of the heavy mechanism. The two motor sledges were in frequent use for the first few days, and hauled most of the hut material to the shore. They pulled about two tons, and one of their functions (most fully appreciated) was that of hauling back empty man-sledges—empty except for the wearied pullers who lay back on the sledges and dreamily regarded the clear sky on their welcome rest between pulls.

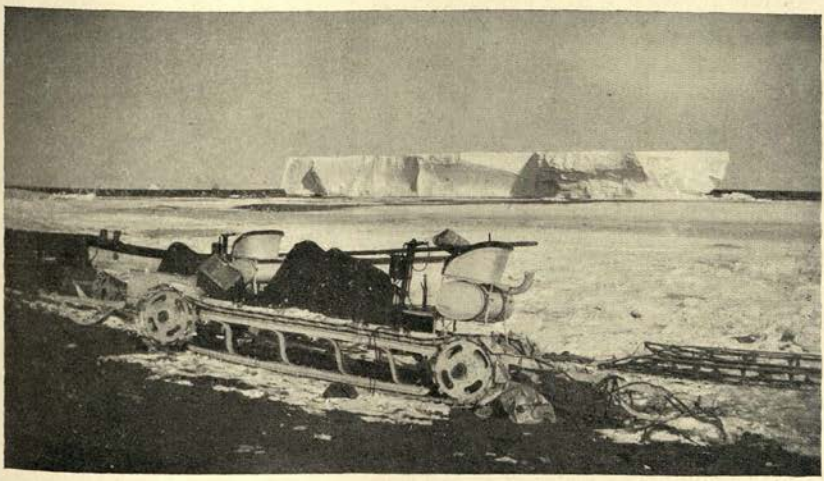
The ponies had been standing continuously for five weeks, and were therefore not very fit for a few days. They were given a short rest at the pony-lines on the snow behind the hut, but soon came into requisition, and have done the greater part of the hauling since. The ponies had, however, many little peculiarities which were troublesome, not only to those uninitiated in the mysteries of pony-driving, but to the experts as well. I shall have more to say on this later.

Let us accompany a man-sledge from the ship to the hut. The question of knots troubles a landsman. At first it was not uncommon for the first jerk to result in the rope parting company with the sledge! The start was always difficult, for the sledges froze to the ice, and it was necessary to "break them out" by extra help.

We had not much eye for the beautiful scenery around, but were very keenly and vitally interested in the surface over which we had to pull the load. Ten feet of clear ice were less difficult to traverse than one foot of snowdrift only an inch deep. The party all wore snow-goggles of amber or green glass to prevent snow-blindness. These fogged from

THE FIRST HOUR ASHORE.

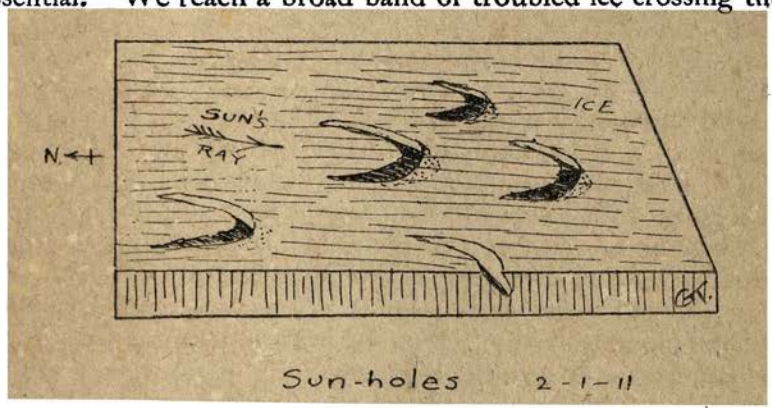
Demetri preventing penguin suicide.



TWO MOTOR SLEDGES ON THE BEACH AT CAPE EVANS, JAN. 20, 1911.

The tabular berg has just grounded where the ship lay at anchor and so she has steamed off to the north. The motor engine is covered by felting. The sea ice can be seen breaking away.

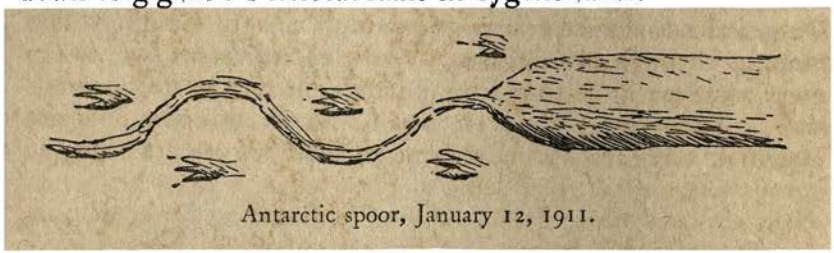
perspiration, and required frequent cleaning unless the sun were very bright, when luckily they warmed up somewhat, and the moisture did not condense so rapidly. At first we would follow the motor trail marked by staves and empty oil drums. But this was too heavily drifted in places, so we deviated south to reach clear ice. All goes merrily until we reach a snow belt. The first sledge touches the snow, and a slight jerk makes us pull to our belts. Another jerk announces the arrival of the second sledge, and if we are pulling three sledges the combined resistance reminds one of hauling three ploughs through stiff wet clay. On this snowdrift we see the pony hoof-marks and the long furrow cut by the dog-driver's staff. Then on to clear ice again, where spiked boots are essential. We reach a broad band of troubled ice crossing the



smooth surface. This is a recemented crevasse, and is practically as strong as the rest of the surface.

The older ice near the shore is "pitted" in a curious fashion. Imagine a red-hot horse-shoe planked down on the ice, with the front forced deeper into the ice. This is the shape and size of these holes, and it seems probable that they might save a man's life in a blizzard; for they are all directed to the south, and would form a sort of compass if he had no better! The explanation is that they are due to the action of the hottest solar rays, which, of course, occur when the sun is in the north. Curiously enough, those small holes have no effect on the sledge haulage, except that they tear the runners somewhat. On another patch of snow is a queer "spoor." A serpentine trail of four or five parallel lines, with large

three-toed footprints, alternating with the curves of the continuous serpentine trails. Suddenly it changes into a broad, shallow gutter in the soft snow! What strange beast has made this? It is of course due to the penguin. As he ponderously heaves from foot to foot his stiff tail feathers swing in unison. When he is tired of this method of progression he drops on his breast and propels himself by his toe-nails. Hence the broad gutter! This trail is very like those fossil prints set down to gigantic Plesiosaurians in bygone times.



Antarctic spoor, January 12, 1911.

To our right is a patch of very dark ice with an evil crack leading to a small pool. We skirt this warily, and are not much surprised to hear a sudden plop! as two or three penguins shoot out of the water and land at our feet, and often right in the way of the sledge. A pony-sledge passes us and then stops—amid our jeers—to breathe the steed, for the ponies are short of wind at this early stage. We hear a steady droning, and the motor rolls by. But we beat across country, while the helmsman is hauling the behemoth on to a new course. The belt is beginning to cramp our muscles, and the steady stab and drag of the ski-sticks at first blister the hands. Soon the welcome bamboo at the camp comes into sight. Snow bridges have been built across the tide-cracks just below the hut. Here the ice rises and falls a couple of feet during the day. We save a little "go" for the last hundred yards, and rush her at the tide-cracks. "Up she rises," and several willing helpers from the hut lend a hand, and so our load pulls up on the belt of snow by the hut. Here Bowers takes charge, and his gang puts the wood near the hut site, the food on another spot, fodder here, and oil in the far corner. Then we run the sledge out of the way to the ice, and if there is no motor returning, pull it back with light loads and rapidly easing muscles to the ship.

We were returning on Friday evening, somewhat wearied,

when Ponting met us and told us the "owner" wished every one to hurry to the ship, for the killer-whales were breaking up the floes, and the stores on the ice would be lost! We ran on and found the sea-ice all broken away at the stern; but Ponting had not explained his own very exciting adventure. Two dogs had broken loose and were racing about at the edge of the ice, when a party of eight killer-whales appeared at the stern of the ship, evidently attracted by these strangely active "seals." An *orca* is twenty to thirty feet long, and has the most fearsome jaw of all the creatures that hunt in the high seas. Thirteen long conical teeth are set in each jaw, each projecting a couple of inches from the bone—and (unlike those of the crab-eater) built for business. Ponting, ever keen on good photographs, took his camera along to get a close view of these fellows. He narrates that they lifted their wicked-looking heads above the water to look at him, and he was just pressing the button, when he felt as if an earthquake had hit him. The whole floe was being broken away by the orcas, and he was separated from firm ice by two feet of water. He did not stop to finish that photo!

After dinner Debenham and I made a trip across the ice to Inaccessible Island. This rises sharply from the sea, about one mile south of the ship, and is usually surrounded by a belt of water—due to the warming action of the very dark rocks of which it is composed. Here we came across our first "sastrugi." They are long, deep furrows cut by the drifting ice crystals in the sides of snow-drifts as they are driven onward by the blizzard winds. Thus they lie on the windward sides of the drifts, and make sledge-travelling very difficult if they face the sledge. If the drifts are across the path of the blizzards the sastrugi may cut right through the former. Inaccessible Island was almost covered with the debris of kenyte lavas, though here and there bosses of solid rock remained, especially towards the summit ridge. In these cold latitudes the frost action breaks down the rocks very rapidly, without destroying the mineral structure to such an extent as is the case in warmer regions. The kenyte weathered into blocks, which irresistibly suggested the Easter Island "idols." Every variety of this rock was found. Some with large crystals an inch long, others like glass, of a chocolate colour; vesicular lava, full of bubbles, looking like petrified bath-

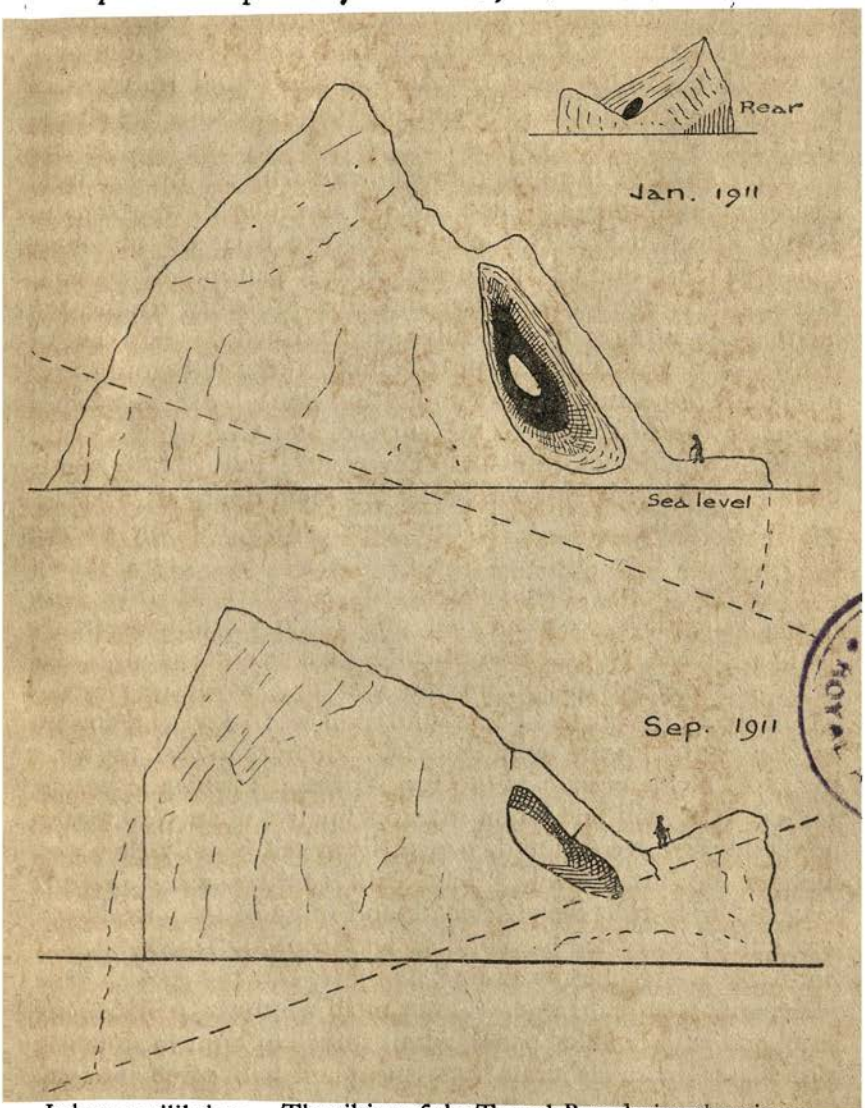
sponges, and pieces of kenyte caught up in a later flow of lava, and burnt just to the tint of a red brick. Just before midnight we returned to the ship, and labelled our specimens in broad sunlight, before turning in.

There are two icebergs stranded off Cape Evans, and Captain Scott arranged that Wright and myself should have some time free to study their structure while the sea-ice was firm around them. He came along himself to have a close view, and Ponting brought a sledge, filled with cameras, to collect photographs. They were both pyramidal, and projected a hundred feet or so above water. Most probably they had been much tilted, for a very prominent layer of snow—which from its included air melted slowly—was now almost vertical. It was obvious that they were affected by the tide, for a pool filled with brash ice almost surrounded them, and we could hear the ice fragments creaking as they rubbed together.

A unique feature occupied our attention most of the time. Traversing the berg from end to end was an oval tunnel, forty feet high and fifteen feet wide, so regular in its outline that it looked as though a red-hot bar had been pushed right through (a distance of 150 feet). The scenic possibilities of this mass of shadow in the midst of the dazzling white of the berg were, of course, fully appreciated by Ponting, and I doubt if any mass of ice has ever been photographed so thoroughly, from the right, from the left, from above, below, outside and from inside, and right through it! By a stroke of almost unbelievable luck the view back through the tunnel just framed the ship at a mile distance. Next day the berg had swung through 180°, the ship had steamed away, and the sea-ice had moved out, so that Ponting was rightly overjoyed at the "fortuitous concourse of atoms," which has given rise to one of the most interesting of his studies.

We were equipped with rope and axes, and cut steps some sixty feet up the berg until we were well over the tunnel. I was much surprised when one of the blows of the ice-axe seemed to set free a strip of orange-peel! Visions of a Japanese hut far to the south floated through my mind, but on examining the object it was found to be a small fossilized fish. I dug it out six inches below the surface, and as the sun melts off quite an appreciable layer every day, this fish

may have been enclosed in the berg for a very long period. The species was probably *Notothenia*, and somewhat resembles



Iceberg equilibrium. The tilting of the Tunnel Berg during the winter, 1911. N.B. The front of the tunnel broke away before September.

the garfish of Australian waters. This reminds me of some rather curious biological specimens discovered by one of the

non-scientific members in our little waterfall. They were white spherical objects, two millimetres wide, which could be peeled like an onion, and each seemed to enclose a little pearl. But Lillie identified them as crystalline lenses from the eyes of *Notothenia*, which were the only things found indigestible by the omnivorous skua gull, and so accumulated in the stream near their nests.

Both ends of the berg tunnel were fringed by beautiful icicles, many being branched almost as much as the famous Jewish candlestick. The exterior of the berg on the more gently sloping side was armoured with a panoply of ploughshares projecting horizontally, and due probably to the sun melting the surface differentially, as described in the case of the sea-ice. It was unpleasant to climb, and a fall would have precipitated one into a most uninviting pool. As we watched it two killer-whales rose to the surface, and "blew off steam" through their dorsal spouts. They moved towards the south, under the solid ice, and we could see them long after spouting occasionally along a narrow open crack leading in that direction.

We were very fortunate in our weather at this time. Bright calm days, so warm that one could sit outside in the lee of a pile of fodder after lunch—as many of us did—and enjoy a short siesta. From the first day work was carried on busily at the hut. The foundation was excellent, for the surface all round our camp consists of kenyte gravel, on which the snow melts as soon as the sun strikes it; which is porous, so that water will not lie on it; and finally, is so springy that our food-cases were not damaged, however heavily they were dumped on the gravel. The main timbers were prepared long before we left New Zealand, and most of the matchboard was cut to size, tied in bundles, and roughly labelled. The floor area is fifty feet by twenty-five feet, and the roof is quite plain, with a central ridge. Three small windows, permanently shut, and with doubled panes, admit sufficient light in summer; while later on an elaborate acetylene plant will come into use. Of greater interest were the precautions to keep out the cold. Vertical tongue and groove matchboard was nailed both outside and inside the framework, an air-space thus being enclosed between them. Next, a layer of a patent quilted seaweed material, made of sea-grass sewn into jute sacking, was tacked

on in two-foot breadths. On the outside this was covered with weather-boarding, and on the inside by another layer of matchboard. The floor was made of thicker boards separated by ruberoid, while the roof has an inner matchboard ceiling—an air-space (with joists, etc.), matchboard, two layers of sea-weed quilt, matchboard, and two layers of ruberoid. Thus every portion of the hut has many layers, each of which is fairly wind-tight. The door opens into an air-tight porch, and this is protected from the south-east blizzards by a wind-screen. A large ventilator on the roof ridge is the only legitimate air-gap, but in one corner the meteorologist has a sort of external cupboard for his instruments, which is bound to be cool. Everything went along swimmingly. The official carpenter and two of the petty officers carved out the more intricate details of carpentering, while the afterguard soon became moderately expert at nailing matchboard, chiefly with geological hammers. One of the scientists (subjected to criticism) complained that he never could drive a nail straight while any one was watching him. His tormentor declared that he must have afforded amusement the whole day, and pointed to a complete series of wilted nails due to the tyro's efforts. For the roof-work the spiked boots of the geologists were in great request, for it was possible for us to manœuvre over the sloping boards at much greater speed than could "Chips" and his assistants.

On Sunday (the 8th) occurred an unfortunate accident, almost the sole mishap since the loss of the ponies in the gale. We swung out the third motor-car, having freed it from its case while it was inboard.

It was landed on the sea-ice safely, and run smartly away to a firmer surface fifty yards away. I then left the ship with a one-man sledge-load bound for the hut. Captain Scott and Lieutenant Campbell were testing the ice, and warned me to be especially careful of certain wet patches near them. I got through to the shore without incident, but this unhappily was not the case with the motor-sledge, which started off immediately afterwards. I was not present, but heard that it was pulled across on to apparently firm ice near the doubtful portion, which had just been crossed safely. There one of the men went through, but was hauled out safely. He declared he felt himself being pulled under the floe by the strong tidal

current. Almost the next moment one corner of the motor-sledge sank, and then gradually the end, and finally the whole of the machine crashed through the ice; and despite the utmost efforts of the hauling party it sank in a hundred fathoms. Thus was lost nearly a thousand pounds' worth of valuable machinery, and since it is made largely of aluminium, it corrodes extremely rapidly, and would not be worth salvage, even if it were possible—now the ice is out—to grapple it at that depth.

During the building of the hut meals were eaten in a huge brown tent alongside, and many of the afterguard slept in small tents on the shore. A new type of these latter looks exactly like a rounded sun-helmet lying on the ground. The rim is represented by the broad flap, which will be covered with snow on sledging journeys, though now a handful of gravel is sufficient to keep them secure.

One evening I strolled into the skuary just behind the camp. Here are hummocks of kenyte with little lakes and shelving gravelly beaches. In the lakes a reddish plant akin to seaweed coats the bottom, and dries to a leathery wrinkled mass. The skuas nest anywhere, not even a semblance of a nest being perceptible. They resent intrusion very strongly, and every one is at first slightly intimidated by the tremendous swoops, rushing wings, fierce eyes, and shrill cries of protest. I wanted a specimen, and decided to test a method of obtaining it, which smacked somewhat of Munchausen when described to me in Australia. Taking a flat slab of kenyte I waited until a skua was approaching. Then, before the bird arrived, I threw the rock into the air almost straight up. The bird collided with it as it was falling, and dropped to the ground stunned. This scheme of hunting is really much more certain than it sounds, for the bird has apparently no fear of objects above it.

The ship was moved to a fresh berth, some five hundred yards nearer the hut, and also nearer the slopes of Erebus. Henceforth almost all the transport was effected by pony teams. There were many incidents at first, for the ponies did not understand the icy surface, and were by no means too subdued by their long voyage to object to most of the duties demanded of them. Hackenschmidt is still obdurate, I believe, but the others have calmed down, and done their

four trips a day as long as it was necessary. One soon gets to know their characteristics. Fiery "Blücher" trots through all the work, whether he is pulling an empty sledge or half a ton through a snowdrift; in fact, the driver is usually dragged alongside over the ten miles involved. With a slippery surface and only a single rope halter, it will readily be understood that four legs can defeat two if the whim seizes him. One gentleman, rejoicing in the name of "Guts," broke away three times, just as I had lugged him the weary mile to the ship, and galloped back unencumbered. But the least-envied duty in the expedition is a morning in the company of "Weary Willie." With drooping lip and stubborn eye, he improves on a crawl only when his driver precedes him with the halter over his shoulder, and practically drags both pony and sledge. In spite of a heavy load of patent fuel, he used to start back two steps to the minute quicker, thinking he was returning to the pony lines, but this soon degenerated to a crawl, and his objections to returning for another load necessitated special help at the turning-point. There was another pony, whom I only discovered on the last day, who was a happy mean between Blücher and Weary. He was anonymous, but deserved a baronetcy. The last loads consisted of patent fuel (in foot cubes) and compressed fodder, while ballast, in the form of thirty tons of kenyte, was loaded from a snow-slide and taken back to the *Terra Nova*.

Many of our minor pursuits irresistibly reminded me of a childhood's day on the sands. There are little trenches to be dug, to lead telephone wires to the Observatory hill; pemmican to be poked out of tins in solid cakes just like the little sand-heaps moulded in toy buckets; miniature bridges over the tiny creeks; and, most realistic of all, grottoes to be carved out of solid banks—not of sand, but of hard, clear ice.

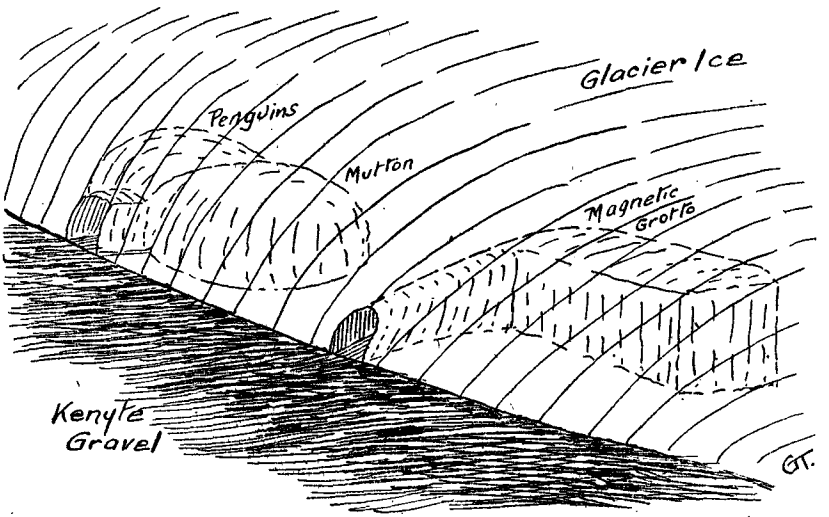
The track to the Observatory hill passes along a miniature glacier with a bank fifteen feet high on the nearer side. In this it was decided to cut an "ice house" for the mutton, and for seals and penguins. Next door the physicists cut out another grotto for magnetic work. Each took about a week to complete.

A "drive" was made into the ice about six feet high and four feet wide. At a convenient distance this was widened

83415

out to fifteen feet, and we should probably have cut out a prosaic rectangular chamber, but that we found that the floor of almost impenetrable frozen kenyte gravel sloped up very steeply. Moreover, the sun melted the "glacier" at a great rate, so that we had to leave a fairly thick roof. These restrictions produced a very pretty style of architecture—a sort of double crypt with a central partition, and gentle, sweeping curved roof, like an opened cockle-shell lying with the convex sides uppermost. The sunlight filtered through the roof and entrance wall, making the ice look like alabaster.

It was hard work chipping the ice. We were helped by



Sketch of two grottoes cut in glacieret near the hut, January 15, 1911.

a few layers of dust mixed with skua feathers—representing very ancient surfaces—along which the ice broke readily. One half was covered with a rough flooring, and on this were deposited a hundred carcases of sheep given by the New Zealand farmers. In the other half a hundred penguins occupy one corner, and later we shall add seal-meat.

A little nearer the hut the physicists excavated an L-shaped grotto, of severely rectangular cross section, and lacking those picturesque sweeps in the roof which were necessary in the other cave. It penetrates the "glacier" for about twenty-five feet, and is entered by an aperture some three feet high. One feels very like a rabbit entering its burrow, but this

constriction is necessary to ensure equable temperature. A mild blizzard was blowing while we were cutting it out, though in the calm—not to say stuffy—atmosphere of the grotto a temperature of twenty below freezing had little effect on one's comfort. To be sure files, and saws, and other iron tools developed an octopus-like surface, for they stuck to one's fingers as if smeared with gum. The wall struts—for the lining—were cemented simply and effectively by a mush of ice and water, which solidified immediately. Two large kenyte boulders formed jagged obstructions on the floor. When foundations for the instrument standards were being made, it was found that under the layer of gravel forming the floor was another layer of ice. It is quite possible that our hut may be built on gravel over a thick ice sheet. This will be tested by a shaft in the winter leisure.

On the highest portion of Cape Evans is hoisted the Union Jack. Near by is the meteorological screen, and two anemometers are merrily whirling round. We have been laying telephone wires across the space between the hill and the hut to connect the instruments there to the meteorological laboratory ("corner" would be a better term) in the hut.

On Sunday 15 work was suspended for a day, for everything was progressing well. Many of the men took ski on to the slopes of Erebus, behind the hut, and had a pleasant time, diversified by many tumbles, in consequence. To the north of these slopes extended the hitherto untraversed Barne glacier, which formerly blocked all communication with Cape Royds during summer. Its seaward face is a high cliff of ice, strongly crevassed, and reaching from Cape Evans to Cape Barne. Wright and myself received permission to go on the glacier, and providing ourselves with an alpine rope, ice axes, food, and wind-proof clothing, we set off up the rocky slopes behind the hut. We soon reached an irregular snow surface deeply pitted where boulders had sunk, with little runnels of water murmuring below the crusts in ice in numberless little gullies. As the ice became more apparent we roped up and marched to the north, gradually ascending the slope of the glacier. Our objective at this time was the rock ridge behind Cape Barne, about two and a half miles away. The glacier came down from Erebus in undulations resembling gigantic rounded steps. It seemed probable to us that the best surface would

occur where the ice was in compression rather than in tension. Here in the hollows the crevasses would tend to close up, and we found them quite readily crossed. In the icy surface were broad ribbons of snow, slightly depressed below the surface, and curving grandly round the undulations of Erebus. These looked solid enough, but an ice axe hardly met with any resistance in the snow, and on sweeping it away one could see a chasm extending indefinitely down. Higher up the slope the snow formed bridges, but here in narrower crevasses it was only of value in veiling the depth. However, it was a mere question of jumping; the leader gathering in the rope and taking a good leap while the follower drove his ice pick into the surface and held on firmly. If there had been any great danger involved, two men would, of course, have been insufficient, but we progressed in this fashion for a mile, then crossed another mile of softish snow without crevasses, and reached the Barne ridge, with rocks running from the coast halfway up to the crater of Erebus. Here to our surprise we saw nothing but kenyte hummocks and debris lying between us and Cape Royds. It would not have been human to have resisted this opportunity of visiting the headquarters of the 1907 expedition. After resting a little among the huge mounds of kenyte boulders—actually bearing small tufts of red and green lichens—we tramped quickly across alternating patches of rock and snow, past small ice-covered lakes, and soon reached Back-door Bay. Here quite a large stream—for Antarctica—was falling over an ice cliff, and we reached the first sign of another settlement. This was a bamboo pole planted in a cairn. Then we scrambled over slopes of kenyte gravel, skirting the rotten ice which filled the outer part of Back-door Bay. The narrow gulf at the north-east end of the bay still contained firm ice, and we crossed this without attracting any remark from a colony of twenty seals, and so reached Cape Royds. Here signs of occupation were very evident, though the hut was some distance away on the further (northern) slope of the hill. A sledge with cases of tinned meat, a ladder, and the tubes of the hand-boring plant, had been left close to the water of Back-door Bay. We carried off a tin of beef in case the hut contained nothing more attractive.

Following some old sledge tracks we topped a rise, and were right on the hut.

Every one is familiar with the appearance of Shackleton's hut. It is very snugly placed in a little dell leading to a small lake, which empties into the sea over some steep cliffs a quarter of a mile away. It seemed extraordinary that so many empty boxes and such piles of debris could have been the result of fourteen months'- stay. I suppose our camp will appear the same three years after we have departed. We skirted round the ruined pony shelter, over boxes of cork packing and cases of empty bottles. The door of the porch had carried away, but the inner door was standing. A foot of ice sealed it at the bottom, but hanging on the door was an envelope addressed in Professor David's hand, "To Any One who may visit Cape Royds." It did not enter his mind when he placed it there that an old student of his would be the first to see this. The envelope contained a short account of the results of the 1907 expedition, left there "in case the *Nimrod* is lost on her return voyage." I carried the record back to Captain Scott, a very interesting document, though luckily not of vital importance, since the expedition's success was not marred by any accident at the eleventh hour.

We then set about getting into the hut. Cutting into the ice with our ice axes we came to a tightly fixed block of wood —which we thought had been placed there to fasten the door. More chips of ice were removed by the ice-axes, and we saw that it was merely a broom, which had fallen down and been embedded its whole length in a foot of ice. There was nothing for it but to cut away this stubborn sentinel, and then it was possible to open the door a foot or so.

We entered with much curiosity. All the windows had been covered with battens, but I did not expect to find it so snug and untouched by the weather. Not a grain of snow seems to have entered. We opened one window, and the place might have been abandoned the day before. On the low table in the centre a meal had been left. Condensed milk, saucers, biscuits, jam, and gingerbread. The latter were very good, and not harmed by two years' exposure. At the back was a tray from the oven with a batch of scones just cooked, and a loaf of bread. I lifted the latter, and the whole outer surface peeled away, leaving a ball in the middle. This is just the way basalt weathers when exposed to the air, and it is

known technically as "spheroidal weathering." I did *not* eat the bread.

The 1907 expedition left in a hurry, I believe, which accounts for the somewhat unkempt appearance of the hut. Boots were scattered on the floor, books over the bunks, socks drying on lines. In one corner a roulette machine, in another a packet of paper used in their printing press. I fear I was most interested in tinned fruits, and searched through a huge store of unused food in one corner of the hut. Tea, pickles, jams, milk, onions, sausages, hams, cocoa, delicatessen, everything but canned fruit. Finally we saw that the dark room was built of cases of bottled fruit, and in honour of the first crossing of the Barne Glacier we broached a case and extracted a bottle of gooseberries and another of currants. It was a queer meal. I had brought bacon and ship's biscuit. Wright selected plum-pudding, sardines, and Nestle's milk. I found preserved ginger, raisins, and corned beef. We drank alternately of currant and gooseberry vinegar, and ate through the above menu. Antarctica is immune from dyspepsia, for we felt none the worse.

We strolled round the headquarters. The penguins were very interesting, for they were busy feeding half-fledged chicks. There are no nests near Cape Evans, but the atmosphere is the purer! I was not prepared for the shape and size of these chicks. They were nearly as tall as their parents, and twice as large round the most important part of their anatomy. Huge balls of dark grey fluff, with feeble little squeaks no louder than a chicken's—in strong contrast to the indignant cries of their parents.

After a couple of hours at Cape Royds we turned south and experienced no difficulty until we reached the crevasses, for we followed our previous track. The crevasses seemed to have widened a little; we were somewhat tired, and the farther edge was now higher than the nearer. In some examples—which we did not tackle—the difference in height reached two feet. However, we crossed them safely (though in two instances one foot went through the soft snow) and reached Cape Evans without misadventure.

Captain Scott had made a journey on a dog-sledge to his old quarters (1902) at Cape Armitage, sixteen miles south of us Unluckily he found his hut filled with ice and practically

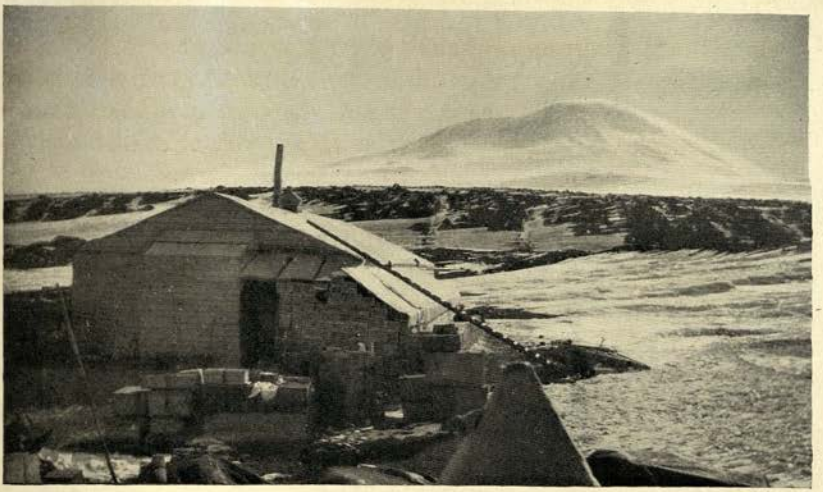
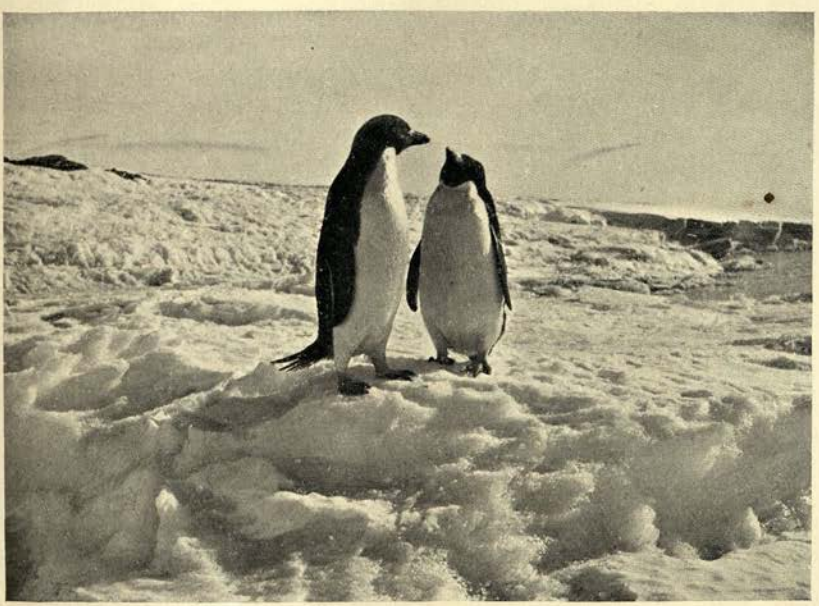


PHOTO OF THE HUT, SHOWING THE RAMP AND EREBUS,
JAN. 20, 1911.

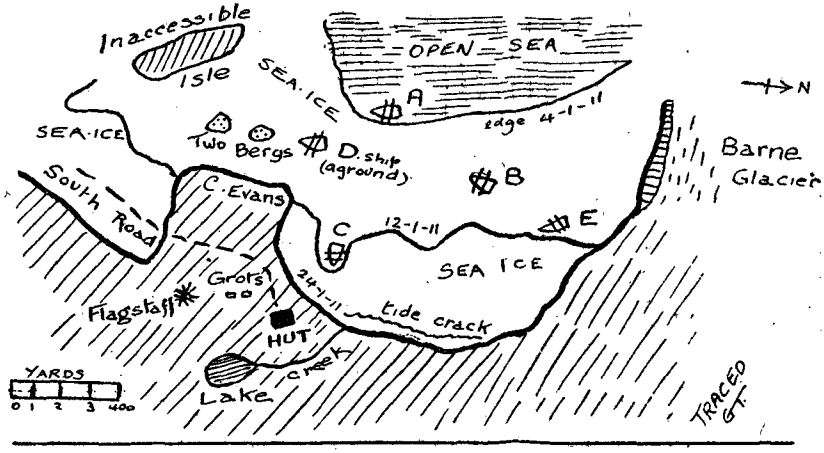
The south annexe built of food cases (on the right) and the stable on the left built of coal blocks are just being finished.



PENGUIN COURTSHIP ON THE ICE-FOOT NEAR CAPE EVANS.

useless, so much so that they slept outside. He had never seen the locality so free from snow. On the 25th of January he hopes to make a start on the depôt journey to the south, and on the same day the western scientific party sets out to explore Dry Valley, Snow Valley, and the Koettlitz Glacier. Captain Scott has honoured me with the charge of this party, whose personnel I have described previously.

We have now occupied our hut for a week. Let me close the story of these early days by describing our life in the hut. To-morrow we leave it for some months of sledge-work, so that we have been very busy for some time past.



First sketch-map made January 21, 1911 (before any survey), showing ice fronts and positions of ship, A–E.

From the porch one enters the quarters assigned to the seamen and cooks. A large galley-stove is placed on the right, and behind it is the chief touch of colour in the hut in the form of rows of tins of food, spices, and utensils. A bunk suspended high up from one corner by an iron rod marks the resting-place of Engineer Lashley. To the left are many wire mattresses supported on neat iron frames. A queer instrument like a guitar cut in half is the cherished possession of Anton, the Russian groom. His comical little bow when you address him—for he speaks no English—reminds me of the action known as "louting low."

"For some time the ship had been lying quite close to the hut—about a quarter of a mile away at the spot C (on the

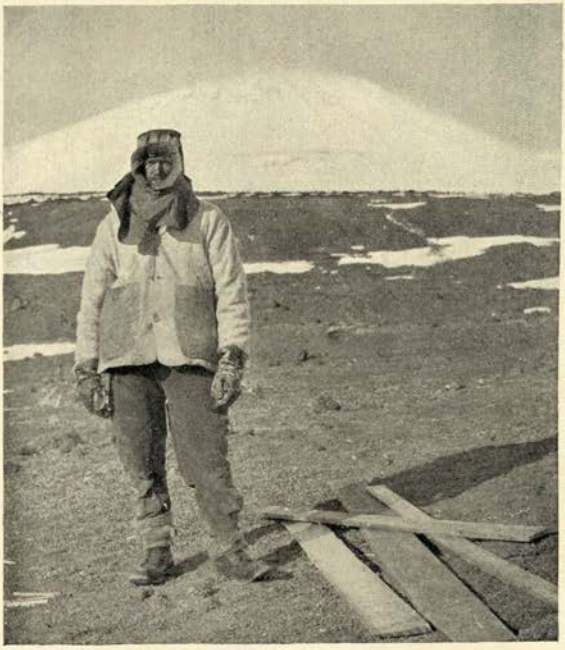
accompanying sketch-map). The original edge of the ice is shown, and here the ship stayed (at A) until the motor sank. Then she moved to B, nearer the Barne Glacier. On the 18th she came along the crack which opened near the stranded bergs to the position C. But seventeen bergs came into sight, and one huge tabular, as if desirous of this site, bore right down on her. So the ship moved across the Sound to get away from the northern wind. In cruising about here, she ran aground at D off Cape Evans. There was sixty feet of water under the stern and only seventeen feet at the bows! That's pretty steep! They 'rocked' her by running across ship in unison, and after an hour got her off. I photographed her from the Cape where the land party watched the efforts of the seamen."

Later I heard that this collision with the reefs of McMurdo Sound tore out a small splinter a foot deep and about ten feet long! Luckily the stout old ship could spare this at her bows without grave inconvenience.

A bulkhead of boxes, amid which two branded "sherry" mark the wherewithal of future festivities, separated the "mess deck" from the "wardroom." The latter occupies two-thirds of the hut, and here the sixteen officers live. A long table extends down the middle and reaches to a palatial inner room, sacred to Ponting, the photographer. The roof of the latter is by no means wasted, but constitutes an important laboratory. At the back are two incubators, not for eggs but for parasites, bacteria, and other pleasant creatures fondly cared for by Dr. Atkinson, whom we expect to see brooding for hours over his pets. The centre of the room is thus accounted for. The right and left are divided into cubicles. First, on the left, are five mattresses assigned to Messrs. Oates, Meares, Bowers, Atkinson, and Cherry-Garrard. The right wall was divided into three compartments, occupied respectively by Messrs. Debenham, Gran and Taylor, Nelson and Day, Simpson and Wright. We have to live in this space for six months of darkness, and as we are limited horizontally to seventeen square feet each, it will not cause surprise to find that we have imitated the New York sky-scrapers. The first few hours of our house furnishing were devoted to amassing enough thick timber to build strong frames for the mattresses. These are built in tiers, and so each cubicle has

SHIP AGROUND ON A REEF OFF CAPE EVANS CLOSE TO THE TUNNEL BERG.

The whale-boat is trying to tow off the ship, while a skua gull on the cape is an interested spectator.



GRIFFITH TAYLOR IN SUMMER RIG (ON A KEEN DAY) ON CAPE EVANS, JAN. 25, 1911.

some clear floor space. In our own cubicle Debenham has raised his bunk five feet from the floor, and underneath this will ultimately develop a whole geological laboratory! In the far corner is a little oil-engine and dynamo, providing current for Dr. Simpson's meteorological apparatus. On a table at one of the two windows is the "counter," an important portion of the biologist's sanctum. The rest of it is below the counter!

Half the left side of the wardroom is in part partitioned off. Captain Scott has one portion of this. His eastern boundary is a huge drawing-table under our second window. On the other side of this, and snugly fenced in by the dark room, are the quarters of Lieutenant Evans and Dr. Wilson.

Near the dark room are the stove and the pianola. The removal of the latter from the ship nearly devastated the officers' quarters afloat. The stairs were removed, and we had to get into the ship's wardroom down a rope during the two days while they struggled with the pianola. However, it has safely arrived, though just the last few days a new gramophone has had greater popularity.

During the two months of our absence the hut will be fitted with acetylene lighting. The four officers and five men who remain have also a contract to kill (and clean) a thousand penguins and skuas, so that they will be as busy as the sledging parties.

Outside the hut the sea waves now wash the kenyte gravel. In the last two days a mile of sea-ice has floated off, and now the *Terra Nova* is hovering around only waiting to land the three parties (south, west, and east) before she turns her prow to the green northern land. All our preparations are made, and we join her to-morrow morning.

The educative value and the interest of an expedition like this is inestimable. I have tried to describe some of the features with which I have been most impressed myself. During the voyage one learns something of seamanship, of biology, of navigation, and of naval matters generally. First-hand information on every conceivable subject from men who have seen many quarters of the world with an appreciative eye is obviously full of interest. The biologist discusses those portions of his subject which touch on geology or meteorology with students who are as anxious to approach

them from other standpoints. In another way also is this expedition almost unique. It is hardly credible that twenty men should associate for three months in somewhat cramped quarters without a jar; yet I can truly say that the best of good fellowship has always existed. This is the best possible omen for success in the future.

[NOTE.—This narrative is left in the form in which it was sent back to Australia in January, 1911, in the belief that nothing is lost (and perhaps some touch of reality gained) by so doing.]

III

FIRST WESTERN EXPEDITION

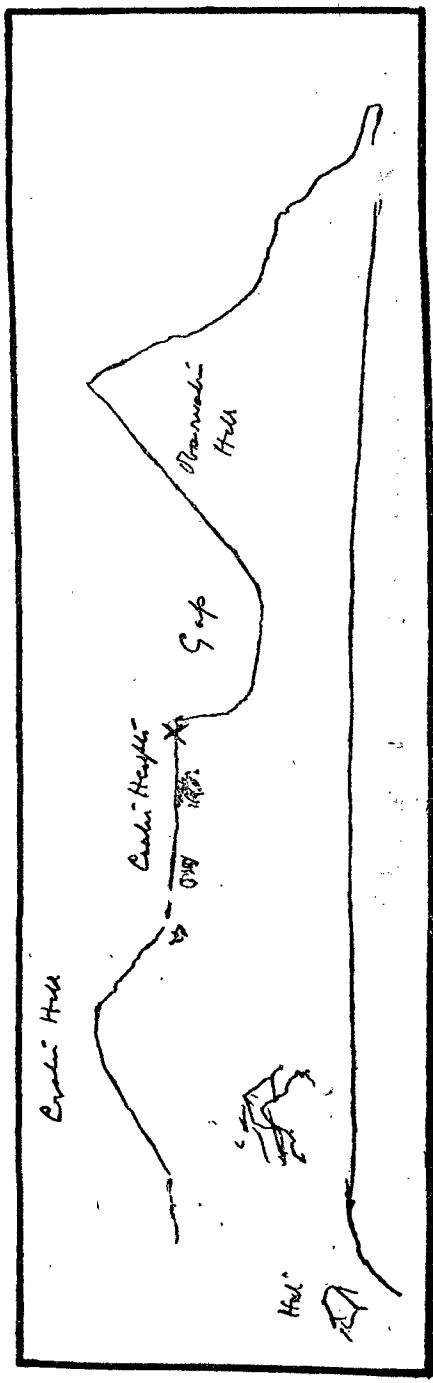
January–March, 1911

On the 24th of January the ponies went over the sea-ice to Glacier Tongue *en route* for the Barrier Depôt trip. Captain Scott and the western party sailed in the *Terra Nova* to the Tongue, which we reached about noon.

Later we were able to study the Tongue in some detail, but we could see that it consisted of a huge pier of ice about half a mile wide, and projecting some five miles from the low cliffs south of Turk's Head. The surface was undulating, and about a hundred feet above the sea in the centre. Its origin is doubtful. Probably it is old piedmont ice anchored on some hidden ridge, but it is added to by blizzards sweeping over the root of the Castle Rock Promontory and depositing snow on the leeward side of the cape. We saw sections of it stranded fifty miles to the north-west later, which proved its partial origin from snowdrifts.

On the 25th Debenham, Wright, and myself marched to Hut Point, where the 1902 hut was situated. We took a light sledge and our sleeping-bags. It was very interesting to recognize the places of which we had read in the "Voyage of the *Discovery*." Castle Rock was very prominent, a huge dark square "keep" about two hundred feet above the promontory; "Danger Slope"—an icy slope dropping down to 150-feet ice cliffs—on which Vince lost his life early in 1903. The conical hill, seven hundred feet high, just east of Vince's Cross, was Observation Hill; destined to carry another cross two years later to the memory of the man who had built the hut below.

Off Hut Point the sea-ice was very rotten and full of huge holes. However, we reached the ice-foot easily enough, and pulled up to the hut. The surroundings were very tidy compared to Shackleton's quarters, which was very natural, for the 1902 expedition practically lived in the ship. It was



Original geological sketch by Captain Scott (January 19, 1911), directing our attention to an unusual outcrop at Hut Point.

surrounded by tremendous eaves, which were meant to protect stores, etc. We found the door blocked by ice, and had to enter by a window. It was filled with snow to a depth of four feet, which had drifted in through various openings. We found a bulwark of biscuit boxes in the middle, and various stores of chocolate, etc. Some brownish powder, after some cogitation, we determined to be pepper. It had quite "lost its savour" in the ten years of exposure. Alongside were the little magnetic huts. Wright commandeered some asbestos sheets for our own magnetic equipment, and then we set off to see the real object of our visit.

Captain Scott had noticed an exposure of lamellar rocks of a sandy appearance among the almost uniformly dark basic rocks of this region, and, although no geologist, he realized that it was possible that a fragment of the well-known Beacon Sandstone (a fossil-bearing rock) had been torn up by a basic lava on its passage to the

surface. This would show the relative age of the two rocks concerned (the lava, of course, being younger), and so was well worth investigating. We found the outcrop readily enough from Captain Scott's sketch, but Debenham and I decided that it was a weathered variety of eruptive rock, and not of sedimentary origin.

Two other appearances were noticeable here, which were worth recording because we saw them later in various other quarters of Victoria Land. We could not account for them from our first example. On the steep face of the cliff (five hundred feet high) near where poor Vince slipped to his doom, were four long horizontal ridges—one above the other—of dark masses of rock. They resembled lateral moraines left by giant glaciers, but I believe they are due to debris rolling down to the foot of a snow-slope. The latter varies in extent with varying seasons, and so the debris ridge may be deposited at another level.

Another very curious feature soon attracted our notice. All the more or less level lowland around Cape Armitage, as well as the bare plateau of Crater Heights, was marked out like a gigantic tesselated pavement. I noted in my journal, "The lowlands of loose black rock appear to be rolled by a steam roller, while the surface is broken by gutters from four to eight inches deep." These gutters marked out hexagonal and polygonal areas some twenty or thirty feet across. When a light snowfall had collected in the gutters, the valleys seemed to have been paved with black tiles united by white mortar.

These symmetrical polygons are due to a slow movement of half-frozen soil, which has been noted in polar lands, and is called solifluxion or soil-creep. We saw many examples of these tesselations in the western moraines.

We walked back to the camp on the sea-ice, pulling the asbestos sheets on the sledge. There was some cold tea to spare in Nelson's tent, and we were glad to make our meal off this and some biscuits. Then, pillowing my head on a camera, I coiled into my sleeping-bag, and so spent my first night on trek.

On the next morning we were told that we could ride back to the ship on the dog-sledges. Nothing loth, we tied our sledge behind Meares', and soon covered the eight miles.

The dogs pulled rapidly, but seemed to need frequent

rests. It was much more lively than "man-hauling." Meares' constant cries, "Tchui—Tchui! Ky—Ky!" directed the leading dog, and the six pairs behind him swerved left or right in unison. There were numerous seals on our route, and Meares had considerable trouble to keep the dogs to the straight path of duty. One ginger seal especially excited their interest, and ours also, for the colour is most uncommon. Usually the seals are a dull fawn brown, though the breast is often beautifully mottled with white spots.

My first seal-killing had been done a day or two before.

After dinner Wright and I had marched off on hunting bent. We walked over the great South Road—where we had cleared a track for the ponies over Cape Evans—and reached Gully Bay. Just over the tide-crack we came on three seals; one beautifully dappled, one small and dark, and a huge, big fellow. We wanted the skin for making sandals, and so attacked the biggest specimen. There was not much attack about it! You just hit him hard on the nose, as Wright did with an ice axe, and then stab him under the fore-flipper, as I did with my Serbish dagger. To make sure, we pole-axed him also. Then we skinned him with considerable difficulty, for two of us could hardly make the body budge! The skin and blubber were two inches thick and frightfully slippery; you could not grip it. We had to drive the ice axe into the loose flap of hide, and so gradually drag the carcase into the positions necessary for flaying. We left the hide on the head and limbs, and then cut through the cartilaginous breastbone and secured the huge liver—about forty pounds of it, I expect. We intended to drag the hide back with a rope, but all we could manage was the liver, of which I hung a part on each fore-finger. Then we walked back to the hut, about half an hour's journey, and when we arrived I gave the liver to the cook. I soon found that my fingers were frostbitten, and through inexperience I stayed in the hut. For five minutes I tramped up and down with an almost unbearable pain in my fingers very like toothache. Never again did I expose my hands in the Antarctic in any constrained position, so that this first slight mishap was a good lesson to me.

On the 27th of January the ship left Glacier Tongue, to carry our party to the western side of MacMurdo Sound, a

distance of thirty miles. I got a photo of the face of the Tongue—showing queer little bulbous icicles where the swell of the tide had licked them. The Tongue rises and falls with the tide, and so there was no very definite crack between it and the sea-ice at its end. Little did we think that this century-old natural wharf was to be torn away from its moorings a few weeks later!

Now that all chance of adding to our equipment had passed, we found that several important matters required attention. For instance, my ski-boots—in which I had to traverse rocky slopes for six weeks—developed a hole thus early in the campaign! This apparently trivial matter bulked very largely in the succeeding journey, and though they were roughly cobbled on board and stiffened with all sorts and conditions of nails—none being very suitable—they were a constant source of worry.

In the afternoon we approached Butter Point, passing through a belt of "brash ice" to reach it. This curiously named headland is where the 1902 party started to explore the western valleys. Here a supply of butter was left for the returning travellers to reward them with a toothsome dish of fried seal's liver (if they had "first caught their seal").

Butter Point is really the north-east end of a "piedmont" glacier. It is a mass of ice—almost stagnant—which covers a coastal shelf some five miles wide between the foothills and the sea. The snow slopes rose rapidly to a hundred feet or so, and then more gradually to five hundred feet. Many unsuccessful attempts to fix an ice-anchor in the hard snow (covering the glacier) resulted in our moving north a short distance, where a grip was obtained when the anchors were carried some two hundred yards inshore.

On the summit of the snow ridge, about half a mile away, we saw the pole of the depôt left by the 1907 expedition. This was now visited by a sledge party to depôt provisions for the forthcoming northern journey in spring.

In the meantime our two sledges were lowered on to the ice, and packed in readiness for our start. The sledges differed in size, one being twelve feet long, and the other only nine feet. The latter Evans evidently regarded as the apple of his eye, but weight for weight it was much less efficient than the

larger sledge, since it weighed almost as much, but could not carry three-quarters of the load. We had a heavy equipment for four men, averaging about 270 lbs. each, but as we were only proposing to take one sledge for a considerable portion of the journey, this was of little importance.

Our total load was as follows :—

		LBS.
Sledges, etc.	Twelve-feet sledge	52
	Nine-feet sledge	47
	Two instrument boxes	14
	Iron under-runners	52
	Total ...	165
Food and Fuel, etc.	Oil tins on platform	78
	One tin of spirits	5½
	Seven weeks' food	250
	Biscuits (four boxes)	196
	Ready bag (one week)	41
	Boxes protecting biscuit	52
	Cooker	7½
	Total ...	630
Tools, etc.	Three ice axes	8½
	Crowbar and shovel	14
	Candles	3
	Lantern	1½
	Alpine rope	11
	Bamboos	2¼
	Tent and poles	26
	Four sleeping-bags	49
	Repair bag, etc.	14
	Total ...	130
Instruments, etc.	Theodolite	11½
	Aneroids, etc.	1
	Zeiss camera	8
	Six dozen plates...	12
	Goerz camera	7
	Three dozen plates	6
	Box camera and films	7
	Polariscope	5
	Binoculars	3
	Compass, abney, etc.	5
	Total ...	65

MODEL OF COUNTRY TRAVERSED ON FIRST JOURNEY.

Outward journeys, Butler Point to Alcove Camp and Butler Point to Heald Island, shown. See also folding map at end of book.

C = Cathedral Rocks. D.I. = West Dailey Island. K = Knob Head. D = Davis Bay Depôt.
H = Heald Island. N = Nussbaum Riegel. W = Walcott Glacier.

Personal Gear			50
			LBS.
Totals ...	Sledges, etc. ...	...	165
	Food, etc.	...	630
	Tools, etc.	...	130
	Instruments, etc. ...	...	65
	Personal	...	50
			1040

Several items in this list may be commented on. The heavy steel sledge runners were designed to fit under the wooden runners of the sledge, to take the wear and tear when we were crossing the rough ice of the glaciers. No favourable occasion for their use arose until half our journey was completed, and then, as will be seen, the trial resulted in the smashing of the large sledge. We also carried the biscuit tins enclosed in their stout wooden cases up and down the Ferrar glacier, with the idea of preserving the biscuits from breakage. The cases were discarded on our return to Butter Point without any inconvenience from broken biscuit resulting. These two items alone constituted one-tenth of our load, and we were glad when trials showed that we could get along much better without them.

It will be noticed that an exceptionally large photographic battery was carried. This was necessitated by the character of the problems which engaged our attention. For instance, Wright was chiefly interested in the forms of ice structure which we encountered. The most delicate ice-crystals, which withered at a breath, must needs be photographed *in situ*. There was no possibility of his bringing back specimens for study in the hut during the dark winter months. For similar reasons a somewhat bulky polariscope—in which sheets of ice were examined in polarized light—formed part of Wright's load, and accompanied him in a ruck-sack wherever he went. Debenham was engaged on the more usual work of collecting specimens, mapping their occurrence in the field, and studying the relations of the various rocks. For this purpose another camera was essential, since in general his investigations were carried out in the cliffs at some distance from the rest of us. The subject which primarily interested myself may be popularly

described as the bearing of geology on scenery—in other words, "How has the land surface been affected by the flow of glaciers, by the action of wind, frost, water, and ice? How do the resulting features differ from those observed in more temperate regions where water plays such an important part and ice erosion is absent?"

During February we obtained nearly a hundred photographs illustrating the typical valleys, glaciers, moraines, and general topography of the western mountains, which it is hoped will help to settle the question, "How do glaciers erode the deep valleys they occupy?" But early in March our cameras became practically useless, for the cold stiffened the shutters and the snow obliterated the details of the landscape.

I asked Pennell to take some soundings off the glacier mouth, for it has been supposed that glaciers cut their troughs out even below the surface of the sea. Rivers, of course, cannot erode below this level, so that this investigation was of importance in connection with the Ice *versus* Water Erosion hypotheses. He found only seventy fathoms (420 feet), which bears little resemblance to the glacier-cut fiords of Norway, some 6000 feet below sea-level. There is often so much silt and debris washing down from these valleys, that it may be possible that a deep rock trough has been filled thereby. But I think it improbable for reasons which will appear later.

Debenham went off with the eastern party to examine the depôt on Butter Point. Priestley was able to identify many of the articles here as having been left by David on the magnificent magnetic Pole journey. Meanwhile, Wright, Evans, and I got our stores and sledges on to the ice and started packing. Some of the seamen went off to kill a seal, accompanied by our doctor, Levick. The latter was to show them a humane and speedy way of ending the seal. He described the method to us on his return, but the effect was spoilt by the butcher declaring that the seal had travelled a hundred yards after Levick had officially killed it!

Debenham had arranged his northern depôt by six o'clock, and then our party put the finishing touches to our two sledges. With the zeal of a new leader, I advised donning wind-proofs as evening drew on; but experience showed later that they were rarely needed until mid-February!

I left my trusty "mousetrap" camera on board, some one snapping a photo of us just before the start.

About 6.30 we pulled off from the ship across the sea ice which separated us from the glacier. The surface was good, and we dragged the sledges about five miles before camping. We headed for the northern side of the glacier. The southern side of the Ferrar was really more direct, but it was cut up into gullies and pinnacles such as made sledging almost impossible.

I asked Evans to cook during the first week; and Debenham was cook's mate, to follow on later. So upon halting Evans took charge of the cooker and proceeded to light the primus, while Wright and I erected the tent over him. Debenham filled the outer cooker with ice and then joined us in piling snow blocks on the flounce of the tent. After seeing that all was secure on the sledges we dived into the tent, and sitting on our rolled-up bags proceeded to change our socks. All of us, except the unfortunate cook, who was too busy mixing pemmican and salt and pepper and thickers—measuring out chocolate and cocoa, etc.—to have any time to attend to socks! This was one reason why cooking was not more popular! Our wet socks were hung on a rope slung upon the sledges, and by morning the frozen moisture had evaporated (ablated) completely off.

However, on this particular evening, while the pemmican was being cooked, Wright and I walked a mile or so to the south and reached a lateral "tongue" or prolongation of the main glacier. There was a sudden rise of some three feet, and the surface, in place of being level and comparatively smooth, was carved out into deep irregular bowls with overhanging margins. These were in all probability giant "sunholes," and their floors were covered with a most beautiful carpet of snow crystals. Examined closely, each crystal plate was like the segment of a fan strengthened by cross-ribs. These plates were often half an inch across.

The whole structure of sunholes, crystals, and hummocking ice reminded me of nothing so much as the appearance of a coral reef, and I suggested the name "coral-reef surface" for the type of ice and snow weathering.

We returned and found the "hoosh" nearly ready. I read the sledging orders which Captain Scott had given me a few days previously.

Letter of Instruction to Griffith Taylor. Esq.

"Terra Nova"

~~Dec. 16.~~
Jan 26th 1911

Dear Taylor,

I propose to disembark a sledge party of which you will have charge on the sea ice of Mc Murdo Sound as near the Ferrar Glacier as possible.

Your companions will be Messrs ~~Bunting~~, Debenham, Wright and Petty Officer Evans.

You will have two sledges with food and equipment for 8 weeks.

The object of your journey will be the geological exploration of the region between the Dry Valley and the Koettlitz Glacier.

Your movements must depend to some extent on the breaking of the sea ice. Your best and safest plan appears to be to carry all your provision up the Ferrar Glacier to a point in the medial moraine abreast of Descent Pass and to make a depot at that point. With a fortnight's food you could then continue the ascent to the junction of the Dry Valley Glacier and descend the valley of that Glacier. On returning to your Depot you will be in a position to observe the extent of the open water and you can either descend the glacier and pass to the East around ~~Hut~~ Butter Point or climb Descent Pass descending by the Blue Glacier or by one of the more Southerly foothill glaciers and thus continue the examination of the Koettlitz Glacier area.

On completion of your work you should cross to Hut Point being careful not to camp near the open water. Supplies of biscuit & other provision will be found at ~~Hut~~ Point ~~but should be used~~

~~sparingly~~

~~sparingly except as regards Stores~~ remaining from the Discovery Expedition and dates will certainly be found near Ram Point. I regard it as practically certain that Cape Evans can be safely reached over the new sea ice ~~in~~ before the third week in March provided that the party keeps well within the bays.

The safest course would be to climb the ridges behind Arrival Height, ~~and~~ beyond Castle Rock, ~~to~~ continue on the sea ice, descend to the sea ice to a point one or two miles from the end of Glacier Tongue and from thence to the South side of Cape Evans,

Wishing you the best of luck

Yours sincerely,

R Scott

It is very probable that you will see some sections of the Depot Party near Castle Rock or East of it on the Barrier - If so you should communicate

As usual we found the pemmican too rich at first, and I note that I could only eat three of the biscuits! This delicate appetite did not survive many days of Antarctic sledging. I slept soundly, only waking once at four; but the thought that I carried the chronometer and was responsible for the punctual rising at 7.30 (6.30 local time) made me uneasy for many ensuing mornings!

We did not expect to return by this route, so that I thought it advisable to investigate the physiography of the lower end of the glacier. After breakfast we all went over to the south side of the valley. Wright was soon busy on hands and knees investigating the beautiful "fan" crystals. Debenham and I walked on further to some isolated moraine heaps, which projected about ten feet above the ice. I made a traverse over the glacier as far as the lower slope of the hills with the following results. The moraine heaps seemed to be the outward and visible sign of a large continuous ridge—or sheet—most of which was buried in old ice and snow. The mingling of fine silts and huge boulders, some four feet long, was characteristic of a glacial deposit, and a few doubtful striæ were present. Many varieties of rock were represented, granites, recalling the famous "Shap" of the Lake District; splendid porphyries with large almond-like felspars in a brown matrix; gneisses of many varieties with parallel layers of glistening mica and dull black hornblende; and some crystalline limestones and much dolerite; both of which occurred *in situ* about ten miles further west. These elongated silt and boulder ridges showed deep cracks along their sides, indicating, I imagine, considerable movement of the glacier which bore them.

The next half a mile was rather difficult travelling, through pinnacle ice and through large lately frozen pools of water. Very striking were some of the ice-forms here. "Topsy-turvy" icicles, whose original support had almost melted away—leaving them attached below and surmounted with knobs like hatpins, and unsupported crusts of ice which dropped one into a pool of water, were types that made the most lasting impression. I soon reached the land—a sunny slope facing the noon sun. Here several merry little brooks hurried down over the powdery silt to hide themselves beneath the glacier. To be sure, they were only an inch deep

and meandered across little channels a couple of feet wide, but they were unusual enough to excite interest. Gradually the silts changed into a pebbly soil, and this into a uniform layer of coarse gravel as I ascended the slope. Larger stones and boulders became common, and one specimen seemed of special interest. It was a fragment of coarse granite some six inches long, with its upper surface weathered to such an extent that every felspar appeared as a separate glistening brick; yet the moiety of the granite buried in the silt was as smooth as any pebble from the beach. I consider it by no means improbable that this relatively large amount of "weathering" had been accomplished while this fragment lay in its present insecure situation.

A little higher up the slope I was amazed to see a carpet of green moss, as flourishing as any in more temperate regions. I sat down on a granite erratic, and noted that three types of vegetation were present. One was a veritable moss, to my unbotanical eyes, the ordinary moss of universal distribution. Of the other two species, which may have been algæ, one resembled the seaweed called *Ulva*, and the other had a somewhat fibrous structure. The patch of green was sixty feet long and about fifteen feet wide, and is possibly the largest area of vegetation south of 77½°! I was under the impression that these forms were quite common around MacMurdo Sound, but if I had known that they were inhabited by a most interesting primitive flea, I should certainly have added some to our load. However, we obtained thousands of the insects next year at Granite Harbour.

On my return I found that Evans had laboriously collected the fragments of a shell, which, pieced together, built up a red scallop. He picked it up on the moraine, where it may have been blown by the wind.

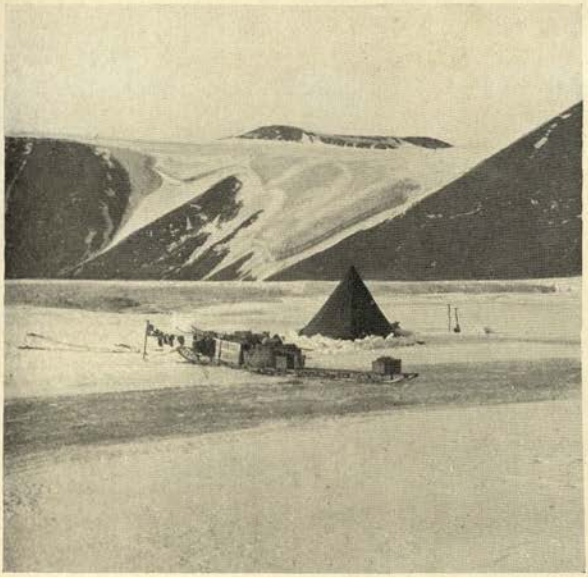
We inspanned at noon, and before lunch reached the low ridges marking the junction of the centre of the glacier with the sea ice. Here we obtained fresh water for the cooker, by cutting some three inches through the sea ice. Evidently at this season the sub-glacial drainage overpowered the sea-water at this spot, which was eight or nine miles from the open sea.

To the north of this was that remarkable "Double Curtain" glacier, which is photographed in the *Discovery* volume. After lunch Wright and I decided to walk in that

direction, and we soon saw we should be justified in devoting some hours to its examination; while Debenham came along later and collected the varied rocks in the vicinity. As we approached the northern slopes the surface of the Ferrar Glacier altered in character, and gave place to large lake-like areas of ice, which exhibited most beautiful figures on close examination. In the upper layers of the ice were included radiating designs which resembled a miniature Hampton Court maze in porcelain embedded in glass. These intricate patterns—which are characteristic of glacier ice—I termed "Arabesques." They are due, I imagine, to some variation in the solidifying water, perhaps owing to air being squeezed into the latest ice formed—or again show where stones have sunk deep into the glacier.

Somewhat nearer the shore there were more unpleasant surfaces met with—large dome-covered ponds into which we fell at frequent intervals. We decided that a tramp over the Crystal Palace would give rise to the same sensations. Bounding the glacier and separated from the debris slopes by a wide stream was an avenue or colonnade of gigantic ice pinnacles thirty feet high. These were traversed by narrow crevasses, down one of which I had to climb to rescue an ice axe. The sun glistening on the icy minarets and beautiful icicles made a most impressive sight. This ice ridge is due to pressure from the glacier piling the ice against the cliff higher up. This crenellated selvage to the more level central level centre of the glacier—moves to the sea with the main body, and so preserves its lateral position, though no pressure can exist where we saw it—for it is many yards from the rock.

Between the pinnacle ridge and the slopes was the water-bearing channel which invariably accompanies a large glacier in these regions. This physiographic feature is one of the most interesting and most important in connection with the characteristic topography of Antarctic valleys. The small valley bounded by ice on one side and rock on the other is conveniently termed the *Lateral moat.* Hereabouts it was rather complex, but further up the main glaciers its valley occupied merely a simple V. After crossing the pinnacles we had to negotiate a stream in which the water lay in pools several feet deep—though its flow was comparatively small. Then over a silt moraine and so across another slight



ROYAL ASIA

MY FIRST CAMP IN ANTARCTICA AT THE SNOUT OF THE FERRAR GLACIER.

Over a mile away is the Double Curtain Cliff Glacier. The Kukri Hills are 3000 feet high. The Snout is only ten feet above the sea-ice on which is the tent. The socks are hung out to dry on the sledge.

Wright. Debenham. Griffith Taylor. Taff Evans.

PHOTO TAKEN JUST BEFORE WE PACKED THE SLEDGES FOR THE FIRST SLEDGE JOURNEY, JAN. 27, 1911.

Note the biscuits in the four venesta cases. The men are wearing windproof blouses.

[See p. 120.

depression to the talus slopes below the "Double Curtain" tributary glaciers. It seemed a simple matter at first to investigate the glacier front, but it lay much further up the slope than I had imagined, and was moreover protected by an icy mantle of frozen thaw-water which surrounded the snout. Wright cut steps across this "mantle," and found that the almost vertical face of the glacier was forty feet high, and composed of layers of snow which had only lately reached the condition of ice.

Meanwhile I climbed up the steep rock slopes alongside the glacier. At first the rocky debris was a confused jumble of granites, dolerites, and basalt, with occasional limestones and gneisses. At 2500 feet elevation I reached the top of the slope and stood on the great shoulder which characterizes the Kukri Hills hereabouts. Here solid rock was plentiful—the same gray granite traversed by long dykes of dark basic rock. A wonderful panorama was spread out before me. I could see up the Ferrar Glacier as far as Knob Head. To the south-west jutted out the three giant gables—like the roof of a Gothic cathedral—which were so appropriately named Cathedral Rocks.

I was much interested in my first view of Descent Pass, by which we proposed to reach the Koettlitz Glacier. Still further to the south-west the spurless wall of the Ferrar was notched by the "Overflow." The latter appeared to spill out through a gloomy curving gorge which indisputably showed evidence of water erosion. In the far west towered the massive Royal Society Range, culminating in Mt. Lister. Its eastern face was carved into rounded "armchair" valleys (cwms) and deep razor-back ridges—another type of topography which has been recognized in temperate regions as characteristic of glacial erosion.

On descending to the main glacier I found that the others had collected several small sponges and shells from the small silt moraine in the lateral moat. These organic remains are puzzling, for it is difficult to imagine that such light and fragile specimens indicate a sea-beach, which could only have raised so many feet above the sea at some far distant period.

Objects of greater biological interest had been encountered on our walk to the side of the glacier. In the rough ice we saw many Emperor Penguins, stolidly motionless and

obviously awaiting the end of their moulting season. We crossed over towards them and found that there were several flocks, probably totalling one hundred.

In the nearest group were thirty-six individuals, only one of which had completed moulting.

He was singled out for sacrifice and fell by a blow on the neck. Evans and I dragged him to our camp, where I skinned and cleaned the carcase in preparation for a change of diet if our appetite failed on a pemmican regime. The limbs I hacked off with my new bowie knife, and I was chagrined to find that penguin bones can chip the best Sheffield blade!

Already my boots began to give trouble. The soft leather sole would not hold the short nails, which only were available on the *Terra Nova*, so that I attempted to mend matters by driving in some Canadian lumber spikes supplied by Wright.

After Wright had taken another round of angles with the theodolite we moved on up the Ferrar Glacier. The surface degenerated rapidly. The flatter portions were sun-carved into serried ranks of projections like plough-shares, and we used the term "Plough-share Ice" to describe this feature. Although this was unpleasant to walk on, yet the sledges travelled over it readily—for as a general rule bad walking meant easy pulling, and *vice versa*. But great holes, two or three feet deep, were cut out below the general level, and these were closer together as we moved further west. They were crusted with fan crystals, and indeed represented a stage of surface evolution which I have described as "coral reef structure." We had much difficulty in guiding the sledges, and they capsized several times before lunch. Every now and again the sledge runners would jam, sending a jar through one's frame, so that this unpleasant experience became known —quite naturally—as a "jam-jar."

Towards evening we approached the first series of pressure rolls. Crossing diagonally (from south to north) were four frozen rivers which formed tempting surfaces, but unfortunately in the wrong direction, for they led to the broken ice of the Overflow.

We camped in an undulation filled deeply with hard snow, a little below a fine tributary glacier and nearly opposite the Overflow.

On the 30th we started up some steep undulations. We had anticipated easy going, for Evans, on his 1902 journeys, had always encountered clear smooth ice here. But the ice was buried under a foot of snow and only showed in occasional holes. I made brief notes of the surfaces throughout the day, at our various halts, and they are characteristic of glacier sledging and so are here reproduced.

"*First Halt.* Heavy going up the undulations; three of them traversed already; the surface is smooth but the runners stick to the snow.

"*Second Halt.* We have crossed the head of quite a deep snow-covered valley crossing the glacier,—on both sides were numerous crevasses, but they were not wide, the largest being under three feet. I slipped in twice, and Evans and Wright had similar mishaps (in no case, however, did both feet go in). Definite snow bridges over crevasses. We halted at a dead seal, obviously a young specimen and yellowish in colour.

"*Third Halt.* We can see a good lateral moraine at the foot of the cliffs, for we are gradually rising up a steep slope with a bad surface. Only a few narrow cracks.

"*Fourth Halt.* Still on the same slope, which is hard going and causes much sweat, chiefly owing to our rather heavy loads, as the slope is only three degrees.

"*Fifth Stage.* Same surfaces; stopped for lunch, having done 3600 paces in three-quarters of an hour (*fide* pedometer).

"*Sixth Stage.* The surface became less damnable and we did a mile in which short patches of ice appeared under one inch of powdery snow. Some 'glass-roof' ice is appearing into which we fall, and the snow is still one foot thick in many places.

"*Seventh Stage* (5 p.m.). We are reaching plough-share ice.

"*Eighth Stage.* Snow is falling on the northern slopes, but does not reach down to our level.

"*Ninth Stage.* Much better surface, nearly all ice, though the snow has powdered it to a greyish colour.

"*Tenth Stage.* 'Arabesques' are showing in the clear ice underfoot, they seem to mark fairly old solid ice and indicate good travelling.

"*Eleventh Stage* (8 p.m.). Crossing the glacier to Cathedral Rocks; surface good, but the moraine seems a long way ahead.

"*Twelfth Stage* (9 p.m.). Stopped near the big moraine after heavy pulling over two inches of soft snow. Camped on big patch of hard snow by a huge boulder."

We spent the forenoon making our depôt at this camp. It lay four miles north-west of Descent Pass, and would be on our route if we decided to return to the sea by the Pass. We left here what we did not require during our fortnight in the Dry Valley region. We piled three biscuit boxes on the smaller sledge, and packed the smaller provision bags under the sledge. We put the butter inside the instrument-box with the spare photographic plates. Also I decided to leave the heavy steel under-runners, for so far we had met with no rough ice. The penguin had been lashed on behind the sledge and had suffered considerably from the capsizes! Him we buried under some blocks of snow, pending a "hoosh" on our return. We took a fortnight's provisions in addition to the "ready-bag," and I tied a note to our depôt flag, mentioning the 11th as the probable date of our return.

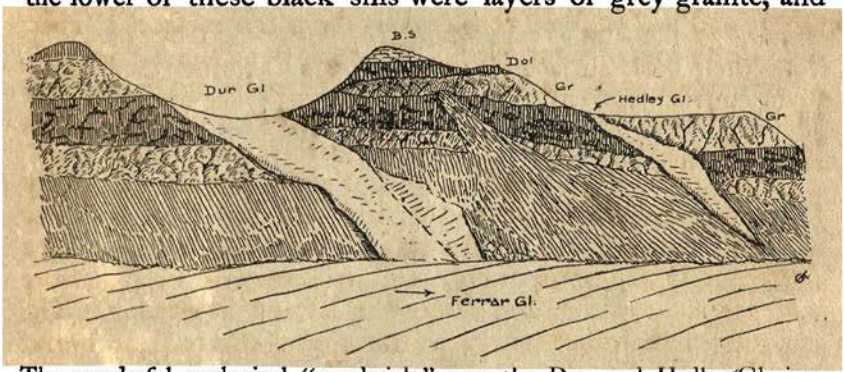
Just to the west of the main Cathedral Rocks was a very interesting tributary valley—the first real low-level tributary of which we had had a good view. Obviously owing to some difference in the snow-supply, this tributary is keeping pace with the main glacier, and enters the latter "at grade." The majority of the other tributaries have not entered the Ferrar on a level (at grade) since it was two thousand feet thicker.

The sun was quite powerful, and we had to wear goggles in consequence, but during our ensuing stay in Dry Valley there was so much bare rock that we had no need for them. At lunch my unlucky boots fell to pieces again, and Evans put some scientific sewing into them. But no sewing held, until continual frost turned the leather into a material almost as strong as steel.

Towards six o'clock we reached the top of the steeper portion of the Ferrar Glacier, and found ourselves on a small ice plateau about 3200 feet above sea-level. On the south it rose to the south arm, while to the north was the entrance to Dry Valley. The col of ice leading in this direction is of considerable interest, for it shows what conditions were like near Luzern in the Great Ice Age. However, I will describe this form of "Twin Glacier" in a later paragraph.

A few miles before we camped we were hauling the sledge

along the foot of the grandest geological section I have ever seen. The cliff was 3300 feet high (as determined by Abney level), and was divided into so many distinct layers that it resembled a gigantic sandwich! It was capped by a little triangle of yellowish rock, which represents the most eastern exposure of the Beacon Sandstone in the valley. Beneath this were two wonderful "sills," or horizontal sheets of the basic lava called dolerite. They could be traced in the cliffs for miles and miles, and represented flows of lava wedged in between the granites and sandstones. These dolerite sills were strongly columnar, and near by some isolated pillars of enormous size were visible on the sky-line. Above and below the lower of these black sills were layers of grey granite, and



The wonderful geological "sandwich" near the Dun and Hedley Glaciers. (The 3000-foot cliff at the south-west end of Kukri Hills, February 10, 1911.) In descending order: *yellow* beacon sandstone; black dolerite; red-grey granite; black dolerite; red-grey granite; dark brown talus.

the lower portions of the granite were shrouded in a steep slope of brownish talus which reached to the flashing white surface of the great glacier.

I hoped to reach the head of the Dry Valley glacier that evening, so that we pulled on till 9 p.m., and reached the beginning of the slope to the north. Here we formed our Fifth Camp just abeam of a tributary glacier—which, from its shape, we called the "South America" glacier. We had some difficulty in fixing the tent-flaps, for the glacier was now practically free from snow-drift, and there was nothing to weight down the skirt of the tent. But the night was calm and warm, so that I walked across to the lateral moat without helmet or gloves in perfect comfort.

February 1, 1911.—To our surprise—after five days' pulling over heavy snow in the Ferrar Glacier—we found no snow in the adjoining valley! We made across the valley a little to reach the medial moraine, and to get away from the disturbed ice at the corner. At lunch we camped in a huge hole alongside a giant boulder of granite. Here alone we found enough snow to secure the tent. Water was obtained from a mass of slushy ice on the sunny side of an adjacent boulder.

Many points of interest appeared round us. All over the clear ice were circular patches of darker ice, varying in size from an inch to two feet. Embedded in the darker ice were the arabesque patterns described previously. These dark patches marked where stones had gradually sunk through the glacier, as the sun's rays—rendered operative by radiation from their dark surfaces—melted the ice around them. As a consequence, only the most massive blocks remained above the ice hereabouts, and the medial moraine—in place of being a continuous ridge of heaped debris—consisted of a block here, another twenty feet off, a third somewhat further, and so on along a line down the valley.

On the slopes of the north, under Obelisk Mountain, were two interesting glaciers. We named them from their shape "Catspaw" and "Stocking" Glaciers. They spread over a low range of hills shaped somewhat like a broad terrace, and from my sketch it seems possible to prove considerable retrogression on the part of the "Catspaw." In 1903 the "paw" was furnished with relics of a well-defined "mantle" in the form of three "claws" prolonging the glacier some hundreds of feet. There was no trace of these in 1911. The irregular outline of this glacier suggests that it originally spread out and perhaps joined with the Stocking (to the east) and other isolated curtain glaciers. Hence the absence of any trace of a valley below these glaciers. They merely "spill" over the broad terrace and hang there supinely, quite unconnected with the main glacier below. This absence of marked erosion is, to my mind, a very important point, and similar features constantly occur.

The gullies in the Solitary Rocks afforded an interesting piece of evidence as to the relation of outcrop to weathering. One of the trials of physiography is to decide how much of the outline of a valley must be set down to the varying

resistances of the rocks involved, and how much is due to the generalized type which marks the physiographic age of the valley. For instance, a narrow gorge usually marks a valley of *late* origin; but it *may* be due to a hard band of granite and be quite local, the rest of the valley having the broader features of the *mature* stage of erosion. To return to our local evidence. I was glad to see that the gullies intersecting the Solitary Rocks crossed the unconformity (junction) between the dolerite and granite without any change in their outline, proving that these two rocks offered much the same resistance to weathering.

As in the Ferrar, the frozen surface streams ran across the glacier diagonally towards the north-east. Perhaps this uniform northerly direction was due to the greater melting on the northern side of the glaciers by the noon sun.

About six o'clock the slope became too steep for the sledges. We halted, therefore, about a mile from the snout and prospected for a good camp site. There was no snow anywhere, and the edge of the glacier was a steep slope some forty feet high, down which it would be little advantage to lower the sledge. The centre of the glacier was cut up by surface streams into asymmetric gullies twenty or thirty feet deep. Along the sunny (southern) side of these gullies were a series of "alcoves" arranged like the stalls of a choir. They were thirty feet deep, and about a hundred across, and were most beautiful objects—their steep faces being fretted into a thousand pilasters and niches.

On the northern side these alcoves were much smaller, but presented the same features. We lowered the sledge down a convenient gully in the wall by means of the alpine ropes, and proceeded to pitch our tent on the rough ice forming the level floor of the alcove. These were ideal conditions for a sheltered camp—with the exception of the floor. We had a strongly-running stream an inch deep alongside which led to an amusing incident one evening. However, it was a good site, and though the wind howled along the surface of the glacier, nothing was even disturbed in our sheltered nook.

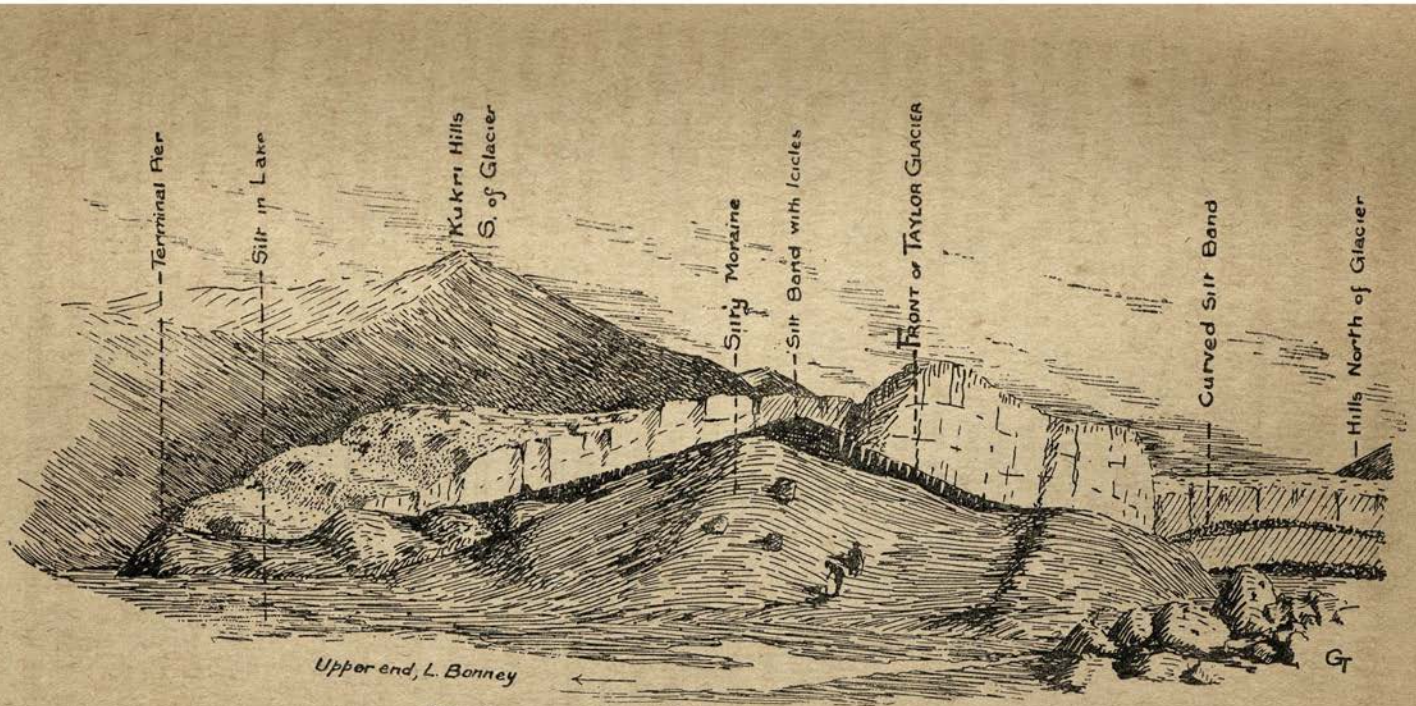
I decided to spend two days round the snout of the glacier before moving down the valley towards the sea. The "groin" blocking the valley attracted my attention, though I was

afraid it might prove to be merely a 500-foot moraine. So we arranged to spend the day in the matters most interesting to us. Debenham climbed up some 2000 feet to the "coaly" debris on the Kukri Hills. Wright (and Evans) investigated the physics of the ice in the vicinity of Alcove Camp. Debenham and I started together down the glacier, and experienced considerable difficulty in leaving the ice. Captain Scott had descended easily enough in 1903, so we kept along the southern edge, seeking a convenient place. The steep lateral slope gave way to a perpendicular cliff over fifty feet high, and we had to cross many ridges and small crevasses before we came to a gully which led to a "silt" fall. Here, partly by slipping and partly by being lowered by the wick-straps of my gloves, I managed to reach the lateral moat, and Debenham followed safely. (Afterwards Debenham cut steps up the less steep face nearer our camp.)

Debenham finally climbed to an outcrop of black lava forming a wall eighty feet high, and obviously representing quite a late phase of volcanic activity.

I carried lunch with me down the valley, and ate it under a huge granite erratic abreast of the snout of the glacier. The slopes of the hills contracted here, and practically enclosed the glacier save for a deep narrow gorge just under the 500-foot groin mentioned above. The slopes were strewn with fragments of grey granite, of fawn granite, and of a felsite containing hornblende laths and "zoned" felspars. Many of the basalt fragments seemed to show the effects of wind action, and exhibited the wedge form of "dreikanter." The latter are elsewhere characteristic of desert regions, where also wind action is more pronounced than water erosion. Many of the large granite erratics contained felspars three inches long, and every gradation between granite, gneiss, and felsite seemed to be present.

Many interesting features were shown by the glacier snout immediately below me. Between the groin—which I named the Bonney Riegel—and the glacier, extended an oval lake about a mile long, and half that in breadth. This connected with a much larger lake to the east by a deep waterway through the Bonney Riegel. The whole lake—some four miles long—I named Lake Bonney, after the President of the British Association, himself a climber and student of the Alps. Between



Moraine material at the Taylor Glacier, looking west.

the lake and the actual face of the glacier was an area of distributed silts, which extended under the glacier; while the latter also contained bands of silt, which were boldly curved in the form of an arch with the centre thirty feet above the limbs. Here the glacier can be exerting no erosive action on its bed, and I believe that for a long period thaw and freeze, wind and water, have been the chief agents in eroding the Taylor Valley hereabouts.

Leaving the glacier and the upper lake, I proceeded east to the Riegel. As I climbed up the slope of the hill, I was delighted to find that it was composed of granite *in situ*. This bar across a great glacial gorge was paralleled by many in the Swiss Alps, and any light which can be thrown on their occurrence in the path of an apparently irresistible power like an immense glacier, will be of interest.

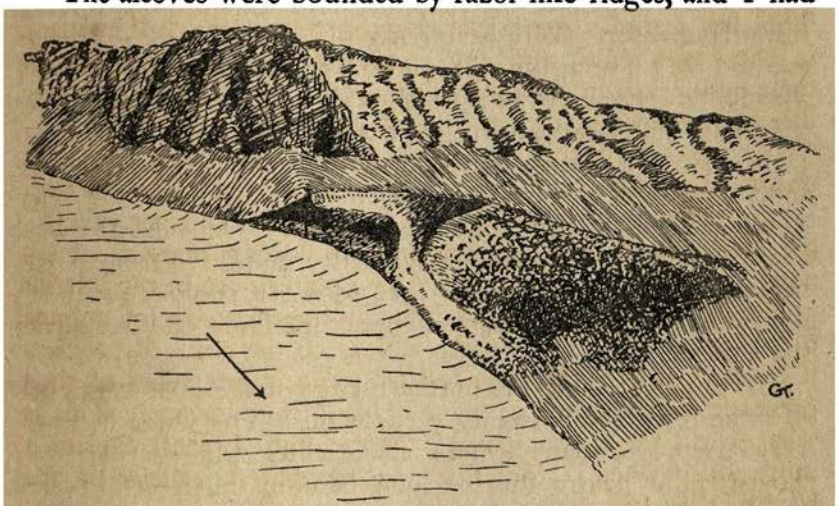
In my opinion this bar (or riegel), and the more important one we discovered some ten miles east, are relics of "steps" in the original topography. A series of "armchair valleys" (or cwms) were first cut out in the sloping margins of the newly snow-covered land area. The plateau-ice in the interior gradually grew in extent, and finally overflowed and drained out through the largest cwm valleys to the sea. By degrees it eroded many of the cwm features, but it left relics of their presence in the form of these "bars" and basins. This is what I call the "palimpsest" theory, and I shall explain it more fully when I describe the elongated valleys of the Koettlitz ice tributaries.

I slid down the steep eastern face of the Riegel, where King Frost had gnawed away the cliff and built up a steep ramp of talus, and reached the channel connecting the two parts of Lake Bonney. This was twenty feet deep and filled with water, of which only the top six inches was frozen. Large laminae of dull green algae covered the bottom of the lake, and just at the snout of the glacier a bright red alga lent an unusual touch of colour.

Perched high up on the shoulder of the valley and close to the Rhone glacier, Debenham made out a small black crater, and I got a fairly good telephotograph of it from our camp. It is probable that the basalt debris I found near the lake had fallen from this crater, which was several hundred feet wide. Its position on this glaciated shoulder is very

interesting, and seems to prove that eruptive action occurred here since the period of maximum glaciation. I managed to cut steps up the front of the glacier and so enter one of the many surface gullies. I had a very unpleasant time getting back to Alcove Camp, a distance of nearly two miles. I thought perhaps the northern side of the glacier, which was flatter, would be easier to negotiate. But the sun had weathered it into a series of small alcoves, whose floors were as smooth as glass and sloped towards the edge of the glacier, here fifty feet high.

The alcoves were bounded by razor-like ridges, and I had



The recent crater on the flank of the Taylor Valley. The Rhone (cliff) glacier appears on the left, February 7, 1911.

to crawl along from one to the other, where I did not cut steps. The others had returned to camp earlier, and Evans proudly produced a fossil-bearing specimen which he called a "whisker-stone." It certainly showed signs of organic life, but they were merely fibrous algae of a type fairly common in the south, so he did not get the reward for the first fossils. That evening Evans kindly sewed "toggles" on my sleeping-bag, so that I could lash it up after I had coiled in. We cut trenches in the ice to lead the thaw-waters away from the tent, and turned in to sleep soundly, though the wind was howling above us along the face of the glacier. But twenty feet below, snugly sheltered in the alcove, nothing disturbed us.

Next morning before rising Wright remarked on the severity of his exercise the day before, which had left him so bathed in perspiration that he felt clammy all night. On examining his sleeping-place, however, he found that something had blocked the stream by the tent, and its icy current had been flowing under his bag most of the night. With the temperature ten below freezing this hydropathic treatment was by no means appreciated by him!

February 4, 1911.—As we could not take the sledge beyond the glacier, we packed up the tent and sleeping-bags with five days' food and our instruments, and carried them down towards the sea. Wright carried his pack in the Canadian method by a "tump-line" round his forehead. He took the theodolite. Evans wrapped his goods and the tent round the tent poles and carried them like a standard over his shoulder. Debenham and I took the food. I found as usual that the Italian method of carrying a harp—a strap over the right shoulder—suited my convenience best. Debenham copied the Australian swagsman with a smaller bundle in front nearly balancing a roll on his back. We took no cooker, and I left my camera below the Riegel after taking some photographs of the latter.

We walked along the northern edge of the lake over a belt of smooth ice about twenty yards wide. The water here was very deep, especially where steep cliffs fringed the lake. Towards the centre the ice soon became much broken, and then a large portion of the centre of the lake was occupied by silt and morainic debris. In fact, the deep water was probably controlled by the radiation from the dark rocks along the shore. The valley was by no means steep-sided as a whole, but there was evidently a well-defined shoulder terrace about 2000 feet above the lake bed on the north and a less marked one on the south. Above them the slope was steeper.

Running into the lake at the east end were several small creeks. One I noticed particularly had cut a fine gully in the moraine of the typical **V** shape. This was twenty feet deep, and its debris was deposited as an alluvial fan or delta. I mention this as an instance of typical water erosion in Antarctica, though later we saw much larger examples.

We had lunch at the east end of Lake Bonney, which

extends four miles east from the snout of the Taylor Glacier. Here the wide valley was filled with morainic debris, and several tributary glaciers were close at hand. A large hanging glacier almost reaches the level of the lake. It is fed by three separate firn-fields, the ice being precipitated over a steep craggy cliff, and then reuniting into a broad glacier below. This I called the Sollas Glacier. Another similar glacier on the northern side almost reached the middle of the valley, and we passed just under its snout. The water from all these glaciers drained into Lake Bonney. I was much surprised to find that after we had passed the lake, the bed of the valley began to rise. This lake evidently occupies an area of internal drainage, and we pressed eastward wondering if we should be stopped by a range of hills. Evans had mentioned seeing in the distance (in 1903) a glacier which completely blocked the valley, so our supposition was not beyond possibility.

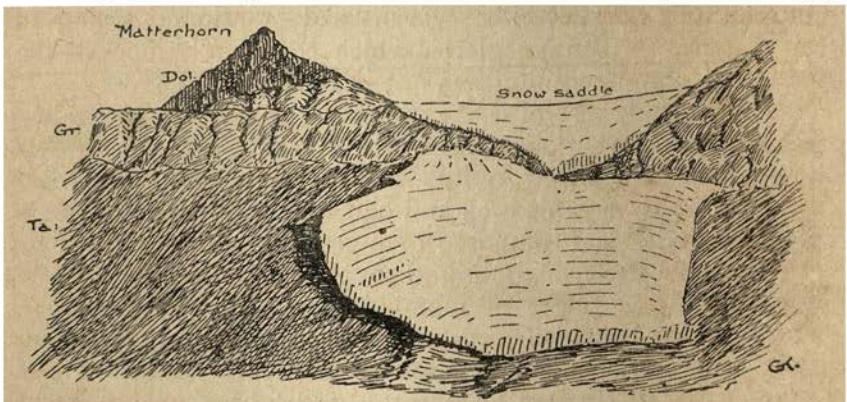
Immediately east of Lake Bonney the bed of the valley was occupied by curious areas which Evans' name of "Football Fields" described quite well. These were four oval areas about 1000 yards long and half that width, as level as a playing-ground and composed of a gravelly silt with insignificant shallow streams winding through each. Separating the "Fields" were ridges of moraine about fifty yards across. The "Fields" gradually became higher in an easterly direction, each, however, maintaining its own particular level. These isolated patches of dead level in the midst of a wilderness of moraine heaps often a hundred feet high need explanation. Level areas of silt under *any* conditions denote material deposited at base level. (This may be the *permanent* base level of all water erosion, *i.e.* the level of the sea, or a *temporary* level, as when a river enters a lake, the latter acting as a base level until it is filled.) The "football fields" represent, therefore, the last stages of a chain of lakes which occupied the bed of the valley at this point. Probably Lake Bonney will gradually be silted up in a similar manner, though here conditions are abnormal, for the drainage is a thorough puzzle. The lake would seem to have no outlet, and yet, as we have seen, it is quite shallow except a mere fringe near the cliffs. In midsummer a great quantity of thaw water runs down from the main glacier. Possibly evaporation and ablation may balance the inflow. It seems improbable that the water soaks

out through the moraine in view of the frozen condition of the moraine a few feet down.

From the football fields we passed under the snout of Lacroix Glacier. This ended in a vertical cliff of ice some thirty feet high, which as usual rested on debris and moraine material.

This glacier was a beautiful example of an avalanche-fed cliff glacier. There was very little connection between the upper firm portion and the lower solid snout of the glacier, the supply being maintained by occasional falls of ice over the great granite cliffs separating the two portions.

Below the snout there was a steep fall through boulders and fragments of granite to the centre of the valley, and along



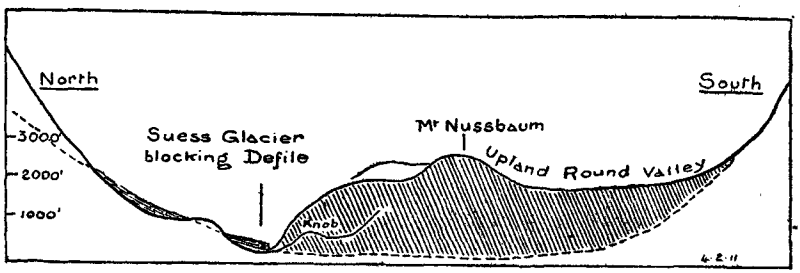
The avalanche-fed Lacroix Glacier in the Taylor Valley, February 7, 1911.

this slope hurried a pleasant little brook three feet across and some three inches deep. It filled the air with as cheerful murmurs as any stream in more favoured latitudes. Lying among the moraines within the next few miles I counted no less than thirteen dead seals in various stages of decay. This fact was of some comfort to us, for we seemed to be ascending continuously, and could see no seaward outlet to the valley. Yet the seals had come through somewhere, and where they could pass, so surely could we!

About three miles beyond Lake Bonney we reached the water parting. The drainage from these high moraines was partly into Lake Bonney and partly to the east. Beyond we could see the valley contracting to a defile while striking knobs

—recalling the Bonney Riegel—bounded the narrow gorge and led to terraces about 1700 feet high. To the south, however, an extension of these, 3000 feet high, quite barred the large valley we had just traversed.

It was now nearly six o'clock and my shoulder was aching with my pack. Judging from the readiness of the others to drop their loads, I concluded that they felt the same. But we all had an idea that a few minutes later would give us a view of the Ross Sea. We wondered if we could pass around the snout of the wonderful tributary immediately in front. It opposed a face of ice forty feet high; but just where it butted into the steep south slope of the defile, there was a narrow gap where thaw-ice had filled in the interspaces between the cliff debris. Over this we carried our packs;

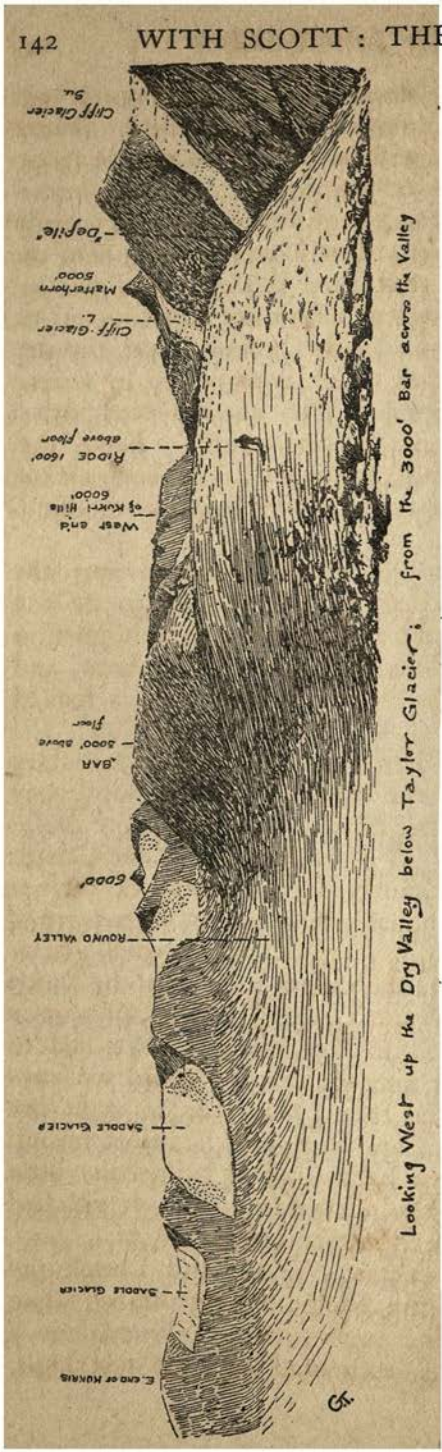


Sketch section across the Taylor Valley at Suess Glacier, showing the Nussbaum Riegel which bars it.

over this the seals must have laboriously crawled to die further inland. One seal reached no less than twenty miles from the sea, and ascended many hundred feet on its death journey. Another, near Solitary Rocks some ten miles further west, at a height of 2000 feet, may have ascended the Ferrar Glacier—an incredible journey for a marine animal like the seal.

We scrambled up the slippery ice mantle below the snout of the Suess Glacier—as we named this striking glacier—and reached the highest portion of the valley since we had left the Taylor Glacier. The rock slopes looked full of interest. Here were vertical strata of limestone and slate, which were the first sedimentary rocks that we had examined *in situ*. Unfortunately they were so folded and altered that no trace of fossils could be expected.

We could not see the sea from the crest of the defile,



Looking West up the Dry Valley below Taylor Glacier; from the 3000' Bar across the Valley

where we were about 300 feet up, and so moved east down the other slope. We reached another lake nearly a mile long with a splendid gravelly shore, on which I decided to pitch the tent. We had brought no floor-cloth; but after the wet and icy floor in the "alcove" we found the warm gravel most comfortable.

We had a frugal meal of biscuit, butter, and cold water. Our beverage from the lake was distinctly medicinal, and as the latter had no outlet we called it Lake Chad.

I was distinctly troubled over the topography of the day's march. We had left a huge open valley—a suitable outlet for a large flow of ice like the Taylor Glacier—and had arrived at a narrow defile completely blocked by the tributary Suess Glacier. We reckoned we must be near the sea; but where was the large open moraine-strewn valley described by Professor David in 1908? I wondered if we had got into an unimportant tributary and missed the main outlet of the valley altogether! So after dinner Evans and I made straight for the top of the ridge (immediately south

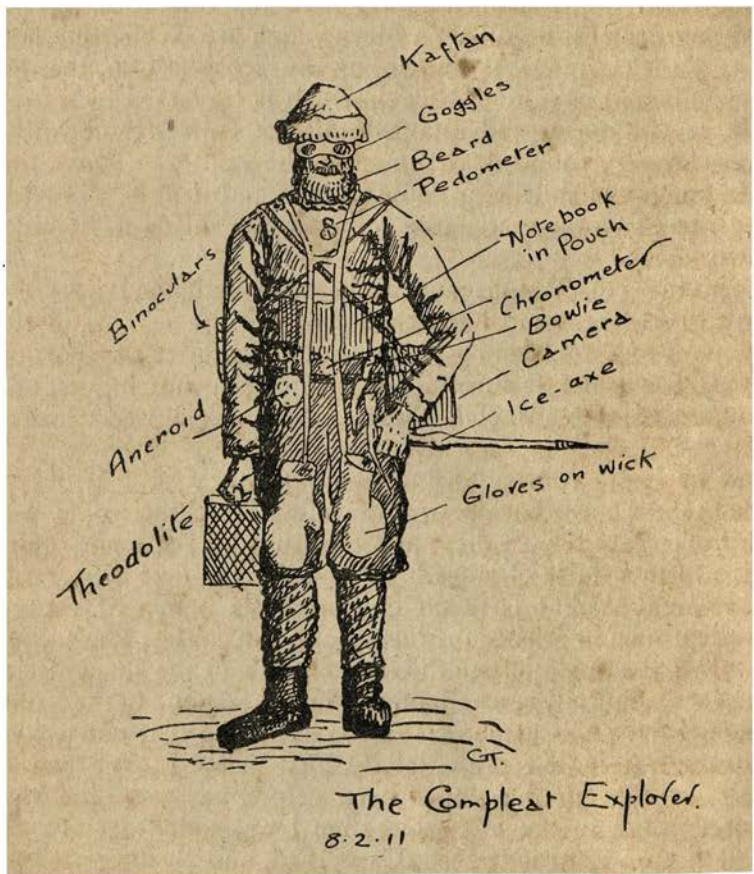
of the tent) which seemed to block the great valley. It was a stiff ascent of 1600 feet over rough blocks of slate. There we reached a flat, bare ridge with a further ascent to 3000 feet a little further west. To my surprise I saw that immediately to the south was a broad high-level valley gradually sloping to the east. I thought at first I was looking into the Ferrar Glacier, but soon saw that here in Antarctica was an example of the extraordinary valleys which are so characteristic of the Italian Alps. As shown by the cross-section, the dry valley is barred by a huge Riegel, which is traversed by a deep defile at the north, and scooped out to some extent into a huge elevated, rounded channel on the south. From this ridge, above the mile-long defile, Evans and I at last saw the sea gleaming in the east across some twelve miles of moraine-strewn valley.

On the 5th, Wright and Debenham remained near the camp, while Evans and I marched down to the sea to tie the survey on to Ross Island—if we could recognize any portion of that far-distant feature. We each carried much gear, and the annexed rough sketch shows how a geologist is loaded when "on trek."

It was extraordinary to find two more very large tributary glaciers on the south side of the valley—reaching some way into the ice-free main valley, and blocking up the main drainage to form a series of lakes. We named the first the Canada Glacier, and Wright later on clustered the names of various Canadian men of science on the adjoining peaks. The second we called the Commonwealth Glacier; and to the small glacier which we ultimately reached, on the north-east end of the Kukri Range, I gave the name of Wales Glacier, so that our party's homelands are well represented in Dry Valley! We had to climb 400 feet up the slopes here before we could see anything definite to the east; but then I was able to sight the theodolite on to Mount Bird, Cape Bird, and Beaufort Island. It was a long and rough tramp back—across numerous little streams, running as usual to the north-east,—but we reached camp again at 9 p.m. and turned in thankfully.

After a somewhat *dry* breakfast, Wright and I took the theodolite up to the top of the Riegel. We climbed some 2400 feet, but did not reach the top of Mount Nussbaum—the central summit,—which I estimated at 3000 feet high.

When we reached the scarp facing up the valley to the west the wind was tempestuous, so that we could not stand against it, much less use the theodolite. We sheltered under the lee of some projecting dykes of dark rock for some little time. There came a lull, and almost before we got the theodolite ready the gale had veered to the east—diametrically opposite

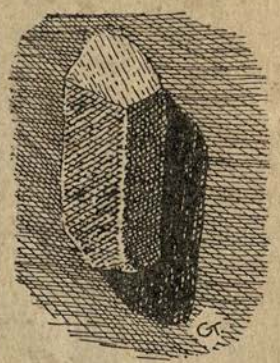


—and continued to blow almost as fiercely from that quarter. This violent storm would have been unsupportable on the Barrier, but the party in our camp below practically felt none of it. Our apparent fine weather was due less to absence of wind than to the absence of loose snow, and to the abundance of shelter.

I tramped to the south and found that the "Round Valley"

1700 foot scarp above the trough containing Lake [illegible]. There was little wonder that we had not realized on [illegible]ward tramp, *viâ* the defile, that such a high-level valley

[illegible]evated ridge was comparatively free from debris, [illegible] were huge erratics of granite with large felspar crystals three inches across. They were wonderfully scooped out by the wind, and were nearly twenty feet across in some cases. We also found small kenyte erratics containing large felspar crystals. These may have been carried across from Mount Erebus, or some unknown locality in the south.



"Anorthoclase" felspar, thrown out of Erebus, 2 inches long. The characteristic mineral in kenyte.

After supper I took the prospecting dish (which was the last article purchased in New Zealand) and washed for gold in the gravels alongside the lake. There were numerous quartz "leads" in the slates and metamorphic gneisses, and eruptive rocks and limestone were in the vicinity. This is a juxtaposition which is always promising, and furnishes the "country rock" of most gold fields. But the quartz was too glistening and pure. It had not the "kindly" rusty appearance which the gold-seeker admires, and so I was not very sanguine. However, water was abundant in Lake Chad and I washed out many pans of dirt. The "tails" of heavy sand were not promising, even pyrites and magnetite being almost absent. We knew there would be no water available on the remainder of our journey, so I depôted the "pan" on a boulder by Lake Chad, where some future archæologist will discover striking evidence for the lost kingdom of Sheba!

Next day we started back to Alcove Camp, buoyed by the thought of hot pemmican after nearly a week's cold "tucker." We lunched just at the east end of Lake Bonney on our old site below the peak of the Matterhorn. The latter is the most striking mountain in the region. The conical summit (formed of black dolerite columns) perched on a broader

granite base, certainly gives it a resemblance to its forerunners in the Alps. We estimated it to be 9000 feet high. Luckily we took careful angles which we worked out later in the hut. To our chagrin all observations resulted in a poor 5000! Such is the effect of lack of trees or any standard of comparison in Antarctic scenery. Continuing west we found that the penguins seemed to have the same queer habits as the seals, for we found a skeleton some fourteen miles from the sea.

We reached Alcove Camp about 5 p.m. and saw that our camp site was ruined by thaw water. We hunted around for a new floor, and the only available one seemed to be a pile of moraine rubble just like a heap of road metal! This we levelled off, and when the ice had melted away in the sun, we pitched our tent upon this stony bed. Then we had a hot meal, much appreciated after our days of cold food.

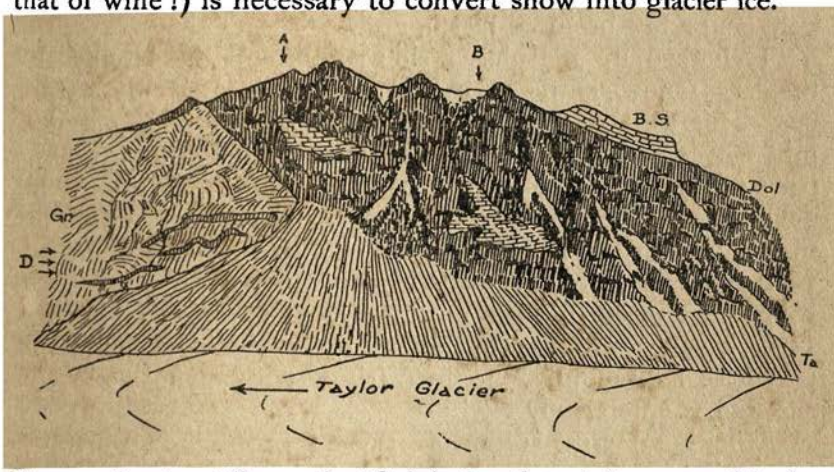
We were up at 7.20, Greenwich time (really 6.20, local) and shifted our gear from the heap of road-metal to the surface of the glacier. We had a good breakfast, though I noted that twelve lumps of sugar did not seem to sweeten the cocoa. It was difficult to move the sledge, for the dark straps had sunk two inches deep in the hard ice and there frozen in again. We managed to get everything ready by 10 a.m., and moved up the glacier. It was very sunny, and Evans wore a huge "Madeira" straw hat, quite a yard across —a queer but useful article that his previous experience had led him to add to his kit.

We had lunch about six miles up the glacier in the medial moraine. I took careful notes of the latter, which differed conspicuously from those of temperate glaciers. It consisted of huge blocks of granite with smaller pieces of dolerite and sandstone. They were often 100 feet apart, so that this moraine compared with Swiss examples was a very "tenuous thread." Comparatively little material can be supplied to these slow moving or stagnant glaciers, and all the small stones have undoubtedly sunk into the ice long ago.

The upper portion of the Kukri Hills hereabouts showed by the fragments of the Beacon Sandstone torn off by the intrusive eruptive rock dolerite that the latter was newer. The relative ages of the other rocks could be deduced in the same way. For instance, the dolerite sent "dykes" into the

granite, so that the latter was older. These points are well shown in the section I sketched.

Near the Solitary Rocks the glacier was moulded into a gigantic furrow or longitudinal undulation. We followed this up toward the ice-falls from the upper glacier and camped for the night on a small patch of snow in the lee of some large boulders of the medial moraine. These boulders had lee-ridges of snow, which, we were interested to see, were generally turned into solid ice and formed part of the glacier itself. This shows that nothing but a maturing process (resembling that of wine !) is necessary to convert snow into glacier ice.



The age of rocks. The granite (Gr.) is the oldest; it is penetrated by flat sheets of dolerite (D) at the junction with the main mass of the latter. The beacon sandstone (B.S.) has also been torn up and surrounded by the dolorite (below A and B), and has probably been lifted up by the lava (to B.S.). The talus (Ta) of loose rock is the latest deposit. From a sketch of the new end of the Kukri Hills made February 1, 1911.

Wright and I went over to the Kukri Hills while the others pitched camp. I wished to measure the "lateral moat." Near the edge of the glacier there was a thick coating of snow. At the actual edge there was a sharp curve downward, and carefully peering over we could see that there was a frozen stream at the bottom of the gully, over 150 feet below us. I determined to measure the slope and angle accurately, and for this we had brought the alpine rope and ice axes. Wright lowered me over the edge, which I found was a snow cornice projecting over six feet. Under the

cornice was a well-defined platform a few feet wide—which, however, narrowed on either side—and then came a long slope to the bottom. Wright paid out the rope, and I let myself down to its end. There I started to cut steps, but unfortunately slipped and fell the last thirty feet—luckily without damage except to my knuckles. I can remember thinking that an ice-axe was an uncomfortable companion in this roll down the slope and so threw it away for fear lest it should claim close acquaintance with my person. The stream was over a hundred feet wide, and then I reached the foot of a steep rocky slope formed of dolerite blocks fallen from a bold crag a few hundred feet up.

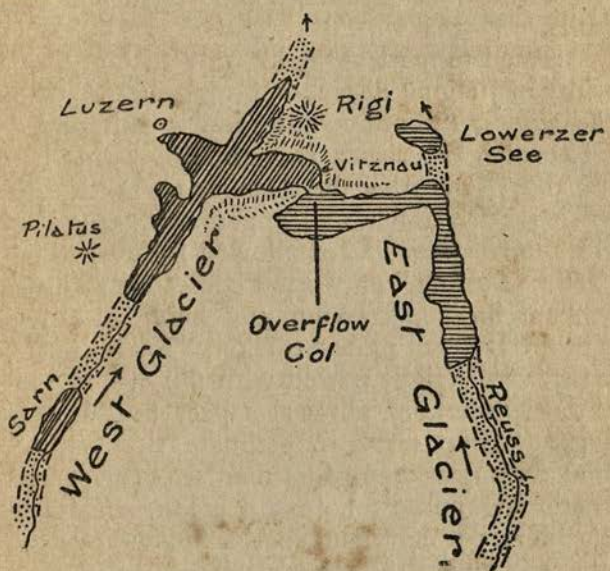
I climbed up the glacier side again, and then found that the large snow-shawls of the cornice prevented my getting back—for as Wright hoisted me the rope merely cut deep into the snow and soon my head was pulled into the lower parts of the huge cornice! I crawled along under the cornice, devoutly trusting it would not avalanche on me, but ultimately had to retrace my steps down to the stream. Again I slipped, and this time lost the skin off my other hand as I rolled once more into the moat. Luckily some few hundred yards north I saw a place where the cornice had fallen off, and here I was pulled up by Wright with such vigour that the ice-axe entered my leg!

The huge cross-section of these "moats" is worthy of note. They definitely prove that no *lateral* erosion of any importance is occurring in this portion of Antarctica. After returning to the tent the glacier treated us to rounds of volley-firing! These were due to the opening of contraction cracks as the ice shrank in the colder night temperatures.

Wright and Evans spent the morning of the 9th over near the ice falls from the upper glacier. These we named after the famous Cavendish laboratory in Cambridge. They had to cross a surface compounded of "plough-shares" and "thumb-marks," which they found intensely slippery, so that even surefooted Evans fell and nearly broke his elbow.

Debenham and I cracked sandstone boulders, but found nought of interest save worm burrows in some shaly bands. However, these indicate damp conditions for some portions of the Beacon Sandstone, and so show that the latter is not perhaps of desert origin.

The most extraordinary feature in this small ice plateau near Knob Head Mountain is that the moraines here lead down into Taylor Glacier. Hence they cut right across the upper portion of glacier above Cavendish Falls, and show that the ice west of the latter is almost wholly flowing into the Dry Valley region and not into the lower Ferrar, as was supposed. This looks as if the "South Arm" and the glacier from the north side of Mount Lister formed the main supply of the



Plan of the bygone *twin* glaciers of Lake Luzern, whose overflow led to the break through the high range near Vitznau. A close parallel with the conditions near Knob Head between the Ferrar and Taylor Glaciers.

Lower Ferrar, while the northern portion (*née* Upper Ferrar and Dry Valley) is a distinct glacier now temporarily united with it after the fashion of the Siamese twins. This type of union is by no means unknown, and indeed explains the structure of Lake Luzern—that beautiful high-cragged chain of lake basins in central Switzerland. Here also two independent glaciers (the Reuss and the Aar) cut out deep parallel gorges as they moved to the north.

They spread out laterally, and ultimately the Reuss Glacier overflowed to the west, and cut through the high ridge forming the picturesque cliffs of the Rigi and opposite shores.

As I have explained elsewhere (p. 280), when, after our return, I described this interesting parallel between Lake Luzern and the "opposed" glaciers at Knob Head, Captain Scott was good enough to honour me by naming the northern "twin" the Taylor Glacier.

That evening we camped near the ice divide between the glaciers. We had intended to ascend the South Arm, but after making our way in that direction for some time, we saw that a snowstorm was brewing, and so turned towards the Kukri Hills.

They seemed to me less than a mile distant, but knowing the difficulty of judging distances, I suggested we should camp under the slopes, "about a mile and a half on." Wright, with his Canadian experience, thought this would be well over two miles, and I remember the distance turned out to be three miles! Thereafter I calculated apparent distances with great care, and when convinced I had allowed for everything I would use a "factor of safety" of 3—and come out about right!

Debenham finished cooking, and being already an adept, had very properly saved some "thickers" for his final "flutter" at breakfast. So Wright started with the evening meal. He imparted a scientific and physical aspect to the operation by suggesting a "drop test" to estimate the viscosity of the pemmican; an observation of its meniscus (or curved surface) to see its sticking power; notes on colour and taste; and—added one of his hungry audience—"I suggest 50 per cent. be subtracted from the cook's allowance on account of grits!"

Perhaps as a result I had a dream in which my astral self did some logical reasoning! It is a fact that the fossils called trilobites gradually become more supple and less clumsily built as one traces them through newer formations. It occurred to me in the dream that this also held true for man and his monkey ancestors, and that the stiff, clumsy orang-outang, etc., developed into the limber human acrobat. Not a very epoch-making correlation, but the best my *astral* self has accomplished to date!

On the evening of the 10th we reached our depôt at Cathedral Rocks. We could see our flag from five miles off with the glasses. On arrival we found the food uncovered, so that the sun had melted the pemmican and butter. The skua

gulls had found the carcase of the Emperor, and our chance of a variation of the menu had departed with the skuas.

That evening we discussed literature. Seaman Evans had read many popular works, and was far superior in this respect to any of the other seamen with whom I had much to do. He had read some of Kipling's poems, and "had no use for them," nor did Dickens appeal to him. As was perhaps natural, he preferred books with more "plot" in them; especially did he delight in the works of the French writer whose name he anglicized as Dum—ass!

Our sledging library was quite extensive, for each of us had devoted a pound of our personal allowance to books. I will give the catalogue, if only as a caution to later explorers. Debenham took my Browning and the "Autocrat"; Evans had a William le Queux and the *Red Magazine;* Wright had two mathematical books, both in German; I took Debenham's Tennyson and three small German books. The *Red Magazine*, the "Autocrat," and Browning were most often read; Evans' contribution being an easy winner. Somehow we didn't hanker after German.

On the 11th Wright and Debenham carried out a very important operation to determine the movement of the Ferrar Glacier. They fixed stakes right across the glacier which were aligned on two prominent peaks. Some six months later Captain Scott re-measured this line, and found that very considerable movement, amounting to thirty feet, had taken place during the winter.

Meanwhile P.O. Evans and I prospected for a route up the steep snow slope of Descent Pass. Evans had been with Armitage when he used this route in 1903. We found the conditions very different. Soon we were sinking nearly two feet at every step in soft snow, through which I knew it would be almost impossible to drag the sledges. The slope soon increased to 11°, so that we found some difficulty in progressing even unencumbered. There I first made the acquaintance of the "Barrier Shudder." Every now and then a shiver would shake the surface, and we could hear the eerie wave of sound expanding like a ripple all around. Sometimes one could see the whole snow surface sinking slightly, and at first the effect was very unpleasant.

We had been roped for two miles and were still ascending.

We now began to get among crevasses, though few were visible through the thick sheet of snow. Quite suddenly I slipped in to the thigh, and sounding with the ice-axe just in front found two inches of snow over the crevasse and very little more behind me. I was evidently standing in a narrow bridge. At the same time Evans called out that he was over another about fifteen feet behind, so that for a few moments things were rather involved. He got back on to firmer ground and hauled me back, and when we saw the surface begin to cave in bodily we decided, in Evans' graphic language, to "give it a miss."

We seemed to be in the least impossible part of the pass, and I could see plenty worse ahead. So I decided to abandon this route and continue down the Ferrar to Butter Point, and so reach the Koettlitz Glacier *viâ* the Piedmont Glacier.

During our absence Wright had also slipped into a crevasse while fixing the stake nearest Cathedral Rocks. We inspanned after lunch, and moved down the glacier to our old camp at the mouth of the Ferrar.

The morning of February 13 was bright and clear. We could see no change in the sea-ice filling New Harbour where we had crossed it a fortnight before. I therefore headed south-east towards Butter Point. Here we had an experience that might have ended our journey prematurely.

We got along at a good rate for two miles, when Evans drew my attention to something black sticking up in the ice just ahead.

We had noticed an unusual creaking sound, which I put down to ice crystals falling, but this strange object demanded investigation. I ran forward a little, and the black spike was obviously the back fin of a killer whale. The creaking was really a warning that the bay ice was on the move. Meanwhile the ice I was on moved off with a jolt, a mark of attention from the killer which we did not appreciate. However, I jumped the three-foot crack which resulted, and we hastened to the fixed ice nearly two miles south. It was a case of "*festina lente*." We could not drag the heavy sledges more than two miles an hour, and were continually crossing cracks where the oozy snow and creaking showed how insecure was our passage. Soon after we reached the Butter Point piedmont the whole bay ice moved off in great floes to the

northward, so that seven miles of it had broken away since the ship landed us. It is quite impossible to tell whether sea-ice is solid or not, for the first cracks are so small and the elevation of the eye so little that the only safe way to traverse sea-ice in late summer is to keep off it!

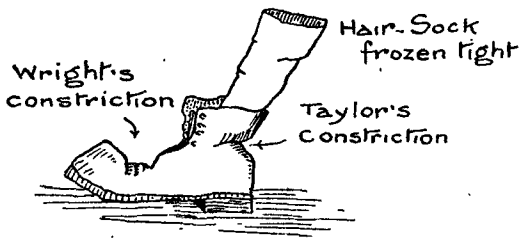
We expected to find the Butter Point piedmont an easy level surface, but of its kind it was the worst I met with down south. All the afternoon we were plugging up an interminable snow slope. Just as one got one's foot braced to draw the sledges through the clinging snow, it would break through a crust and sink nearly to the knee. Then we would meet a few yards of firmer surface and bet whether we could make a dozen steps before the soft "mullock" started again. Even worse was the jar when you expected deep snow and found a firm crust one inch below the surface. I carried a pedometer, and when we had done 27,500 of these paces I felt we had earned our supper.

Blue Glacier now confronted us. P.O. Evans and I prospected across the snout, and were glad to find that though it showed crevasses in places, yet it was so free from snow that we should have no great difficulty in crossing them. They curved round parallel to the coast, and, of course, lay along the line of our march, so that we came on to them end-on and fell in several times. But by the evening of the 15th we were safely camped in the rugged ice south of the crevassed portion. Evans as usual enlivened us with navy yarns. He illustrated the kindness of the sailorman by a story of a mate of his who started a poultry-farm. To Jack's disgust the ducks in his yard had no belief in altruism and with their broad bills gave the hens no chance. "So," said Taff Evans, "evenchooly he gets a file and trims their bills like the hens, and then everything went all sprowsy!"

If any one had asked us what we should like sent post haste from civilization, there would have been a unanimous yell of "Boots!" The rough scrambling over the rocks and jagged ice of the past fortnight, and the alternate soaking and freezing they had experienced, had ruined mine completely. Deep constrictions formed in the leather across the toe and behind the ankle and raised great blisters, and even boils in Debenham's case. I had no sole on the right foot, but within the next day or so the temperature fell considerably

and the thin leather lining froze as hard as steel and so protected my foot. For days a loose boot-nail which had accidentally been pressed sideways into the sole when it was wet clung like a leech!

Each morning we had a painful ceremony when it was necessary to don our frozen boots. Remarks more fervid



The Morphology of frozen Ski-boots.
15 2 11

than polite flew about the tent, and some of us found that quotations from the poet philosopher lubricated the process.

> ". . . Gritstone,—gritstone a-crumble:
> Clammy squares that sweat, as if the corpse they keep
> Were oozing through"

was supposed to be a very potent incantation. We carried no blacking, but this ceremony was called "Browning the Boots."

Open water washed the face of the Blue Glacier. Black snaky heads—reminding me of prehistoric plesiosaurs—could be seen darting about amid the brash ice. They were Emperor penguins, which swim with their bodies submerged.

To the south of us stretched the sea ice, which was evidently rotten and ready to move north. Beyond the Blue Glacier on the right stretched a broad fringe of moraine which extended fairly continuously along the north side of the Koettlitz Glacier. Immediately ahead of us was a fifty-foot ice cliff, but some distance to the south we found a lower place and managed with the Alpine rope to lower the sledges down to the sea ice. We crossed the "pressure ice"—where great cakes had been up-ended to form a frozen rampart—and reached a good sledging surface at last. Near by was a great pool of water containing many seals, where jostling ice pancakes were surging about, so there was obviously no time to

lose. We pushed gaily south and camped that night in a little gravelly dell among the moraines.

This crater-like dell was occupied by a frozen lakelet of greenish ice, the colour being due to algæ. On the slope above the lake was a blanket of alga forming a sort of peaty layer an inch thick.

The latter was apparently *in situ*, for it extended uniformly for about ten feet. This occurrence of peat points to an elevated old lake bottom, and we saw similar examples later on our journey. Even in Antarctica at present we see that considerable organic material is deposited, which might form a thin coaly layer in succeeding ages under suitable conditions. Indeed, the kerosene shale deposits of Australia are supposed to originate in some lowly plant-form like these algæ.

February 17, 1911.—We had a calm, clear night, and all slept very well on the soft sand of the moraine crater. Just to northward was a little bay filled with pancake-ice having two-feet motion. We made south across little bays over a very good surface, which was intersected by cross-channels of clear ice. Seals were very numerous along this coast. We counted one group of thirty. We could now see the first of the Ice Slabs (described in 1902), which seemed in its lower portion to run parallel to the coast.

Wright espied some white material in the moraines, and we walked across to see this. It turned out to be a huge deposit of Mirabilite (sodium sulphate), about ten feet across and fifty feet long. It was granular in texture, and the dip of the bed was quite high. The Mirabilite was originally a level deposit in a saline lake, so that, just as in the case of the algæ, we have evidence of strong upheaval of the moraine silts, since they experienced a long-continued phase of equilibrium. The granular mass was not unlike rock-salt in appearance.

We proceeded south and crossed the mouth of the large bay marked on the Discovery map. We halted off the southern headland for lunch.

I had a small adventure which might have been serious. On outspanning—which consisted in freeing one's harness from the sledge—I walked over to look at a seal which had crawled about a hundred feet from the tide crack. He shook his head angrily at me, so that I made a loop on my harness—still attached to my belt—and lassoed him with unexpected ease.

The seal bolted for the tide crack—and for a short distance they can "lollop along" fairly rapidly. It was amusing, at first, being pulled by an angry seal; but it suddenly struck me, "What will happen when the brute dives into the pool?" I could not get the loop off his neck, and had as much chance of stopping him as a railway train. I experienced some anxious moments before I managed to get ahead of him and jerk off the lasso, for it was impossible to slip out of the broad waistbelt in time. This adventure furnished considerable amusement to my unfeeling comrades, and became the subject of one of Wilson's sketches in the *South Polar Times*.

After lunch we took a round of sights from this low headland. It was composed of moraine heaps with numerous circular sheets of water, which reminded one most strongly of crater lakes. On descending from the cape, Debenham found that the steep little cliff near the tide crack was formed of ice covered with a mere veneer of moraine silt. Probably a large portion of the promontory was ice, and we saw other examples of this pseudo-moraine further up the Koettlitz. As Debenham suggested, the crater lakes were due, in all probability, to the melting of the foundation ice. Probably the sun's rays acting on the silt in a shallow pool have a powerful effect in deepening the lake when it is once initiated. The drainage of such a lake presents some difficulties, for though there was usually an apparent outlet, many were quite enclosed by a circular wall of debris. Steps of silt, appearing as small terraces, were common among the heaps. These probably represent crevasses in the underlying ice, and we actually saw several such crevasses in the ice exposure noted above. Perhaps these crevasses account for the (hidden) drainage, for ablation could not empty many of the lakes. The whole question of the origin of these unusual lakes is of great physiographic interest.

We could see fairly rough ice ahead, but hoped to be able to get the two sledges several miles further before depôting one during our work on the Koettlitz.

We proceeded somewhat to the east over blue ice. This soon became rippled and degenerated rapidly into a fearful "glass-house" and "bottle-glass" surface. We started to fall through the ice into hidden channels, and in some cases there was a foot of fresh water awaiting us. Things got

worse and worse. We wriggled round ice "mesas" with vertical walls, over huge curved platforms which threw us all together in the centre and then dropped beneath us. We thought it might be better nearer the land, but at last had to lower the sledge down two feet to the lower level, which was silt covered and all the harder to sledge on for that reason. The "mesas" showed three layers. A flat cake of solid ice on top, then a few inches of very much weathered ice, and below a solid pedestal about three feet high. We hoisted the bamboo and flag and spread out to prospect. The ice became worse towards the coast, but Wright reported somewhat better going towards the centre of the gulf. However, it was obviously unwise to drag our unnecessary sledge further, so we turned in our tracks and crossing many "glass-houses" (into most of which we fell, though with little damage) we made for the headland where we had lunched.

It began to snow and looked very threatening around Mount Discovery. There was an ugly luminous patch in the sky to the south-west, and a heavy snow cloud with a very ragged edge. On Erebus alone was a red-gold ray of sunshine. From these portents Evans prophesied a blizzard. We reached land without undue difficulty and crossed the pressure ice, pitching our tent in a dell not unlike our last camp, though it was flatter and more exposed to the east. We carried the smaller sledge well inland, but left the large sledge below on the sea ice, for we should have had to manœuvre it round an open channel, and we did not need it for laying our depôt here. This channel along the coast was about twenty feet across with a five-knot current in it, which was flowing strongly north. Seals swam up it quite frequently, and often used to halt and observe the strange visitors alongside. While the pemmican was cooking I went on to the ice and killed a seal and extracted his liver.

This camp marked the end of the third week. We celebrated it by eating a pound of mixed chocolates. Wily Evans led us to believe that *he* was the donor; but as a matter of fact, each sledge had a box of them packed in for birthdays and feastdays.

The snow stopped about 8 p.m., but later in the night a strong wind from the south-east blew much sand on to the tent. We had an argument as to whether this was a blizzard

or not, for there was no snow in the wind. Personally I now think it tends to prove that the snow in the blizzards is largely *old* snow caught up again, for the force and direction of the wind were just those of typical blizzards. We were protected from the open barrier surface by Brown Island and the Koettlitz glacier, and this region is one of small snowfall in any case. So we were not inconvenienced by such blizzards as blew on this western coast.

The food was lasting out well. The first tin of biscuits was finished, and had lasted from the 3rd instant. (We had, however, an extra bag of loose biscuits.) I started my week of cooking on the 18th, and as we reached Hut Point in the seventh week I had only one turn at this duty.

February 18, 1911.—It seemed advisable to get a good view of the Koettlitz from some high peak, so I decided to spend a few days in the vicinity of this camp before marching up the big glacier. We had a "make and mend" morning—sadly needed by our boots. I had saved some staples from the venesta boxes (thrown away at Butter Point) and found they were satisfactory in holding the soles together. Luckily the others' boots were very much better, though Debenham's were much improved by some of Evans' sewing. We had a large fry of seal's liver in butter, and Debenham and myself decided that as raw blubber tasted passably, we would fry liver in blubber for the next meal off seal meat.

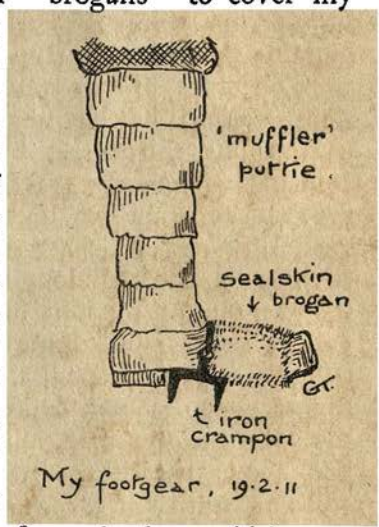
In the afternoon Wright and I crossed Davis Bay to the mouth of Hobbs Glacier (about two miles to the north-west). The promontory on which we were camped was about a quarter of a mile across, chiefly built of basalt fragments rich in olivine.

The shore of the bay below Hobbs Glacier was in the form of an extraordinarily flat alluvial fan. This uniform level extended almost to the glacier for three-quarters of a mile, though it narrowed greatly away from the bay. It was mapped out in square "tesselations," and at the sides were striking terraces about five feet higher with strongly marked, clean cut edges. The whole topography had a very recent appearance; but the only explanation I can give for these levels points to a period when Davis Bay was dammed by ice so as to raise the waterline to the levels of the various terraces. A parallel case of terraces in a waterless region is given in

re the hills around the great basin are fringed by posits indicating a bygone lake.

the fan ran a creek from the glacier, which cut into the shore to a depth of several feet. Evidently the base-line has been lowered by this amount since the fan was deposited. From the hill above the bay it could be seen that there were two fans, one of a lighter coloured silt being derived from the next valley to the south. We could also see that our camp was really on an island which corresponded to the stranded moraines south of Butter Point.

February 19, 1911.—I cut out some sealskin from the carcase near-by to make a pair of "brogans" to cover my boots, lashing them over the sole with yarn, and over the sealskin I bound my iron crampons (steigeisen) on. Then we all started to explore the valley immediately west of Davis Bay and south of the Hobbs Glacier. Leaving the sea-ice we reached a lighter coloured "fan" by a sharp step of five feet. Emerging through this broad gravel fan were "nunataks" of large stones which had evidently been deposited before the fan. They rose twenty or thirty feet above the fan, forming ridges leading towards the valley. We reached a gully about 500 yards from the bay, which was entirely water-cut, and was fifty feet deep. It had steep sides and its bed sloped considerably. The latter was filled with large rounded boulders, one or two feet in diameter, obviously waterworn. The account of the summer streams in 1903, given by Dr. Wilson, explains this striking example of ordinary *water* erosion, which I was unprepared to meet in icy Antarctica.



The gully wound about through the morainic foot-hills, and widened considerably about a mile higher. Here it was occupied by an ice-sheet some 300 feet wide. In this sheet narrow little canyons four feet deep had been cut by the water, and very generally these canyons were roofed with ice.

In other places the whole ice-shell had been [illegible] thirty or forty feet by the relatively warm water.

Gradually the valley—which I named after Professor W. M. Davis—became wider, and a tributary joined it from the north. (See folding map at the end of the volume, and also p. 175, section No. II.) It drained the lowest slopes of the foothills, which extended to the scarp of the Western Mountains. These lowest slopes are largely covered by a gigantic deposit of moraine matter. This deposit extends many miles along the foothills, and can only be due to the great Koettlitz glacier.

Four or five miles from the coast the steep hill-sides formed of solid rock rise somewhat abruptly from the moraine slopes to a fairly uniform height of 3000 feet.

The sides of the valley along which we were walking were marked by lateral ridges in several tiers. These were about thirty feet high, and in some cases certainly contained much ice. At one spot the silty covering of the side of one of these lateral ridges was marked by vertical stripes of darker silt, as if the whole ridge had moved slightly and cracked along these lines. These ridges followed the contour of the hill between the tributary and the main valley, and reminded me of the parallel roads of Glenroy (though on a very small scale, of course). They are, I think, like terraces or beach deposits due to a bygone ice dam across the mouth of the main valley, such as one sees in the Märjelen See above Fiesch in Switzerland. Later we saw "pocket editions" on Cape Evans.

Continuing up the valley we found it bounded between solid cliffs of limestone, which were altered in places to a marble. We called these the marble cliffs, and they culminated in a double peak of a fawn tint, which we called Salmon Peak from its colour. I kept along the base of these cliffs while the others walked up the thal-weg 200 feet lower. We soon saw that the upper portion of this "dry" valley was occupied by a glacier, whose snout was forty feet high.

Some light snow had fallen lately and occupied the furrows of the "tesselations" which ornamented the floor of the valley. For some reason (probably the direction of the wind and sun's rays) only the north-south furrows were now filled,

and these white zigzag markings on the black basalt-debris resembled so many white snakes!

The Davis Glacier snout was about six miles from the sea. A range of mountains 4000 feet high blocked the upper end of the U-shaped valley. I was very anxious to see whether the glacier really came into the valley from some hidden angle, for if not this glacier was of great interest. Here was a glacier which could not be more than eight miles long, which had cut out a valley 3000 feet deep and a mile or so broad.

We separated here, Wright and the others taking the theodolite up a 3000 feet hill to the south, while I went a couple

Empty hanging valley, on north wall of the Davis Glacier, showing catenary curve due to former glaciation, February 19, 1911.

of miles further into the range to see the head of the glacier.

Everywhere were the signs of recent recession of the Davis Glacier. First I had to cross the mouth of a side valley opening 600 feet above the glacier. This was quite free from ice, and was a perfect "bowl-valley" or cwm. On the opposite side was another "hanging valley" at a lower elevation, with a most symmetrical U-cross section. It was abruptly truncated by the plane surface (35°) of the marble cliffs under Salmon Peak. I now climbed round the top of a cliff of ice which descended smoothly for 1000 feet to the glacier at an angle of 30°. After ascending over many outcrops of limestone schist, granite, and basic dykes, I reached the head of the glacier and saw that it originated in a cwm about three

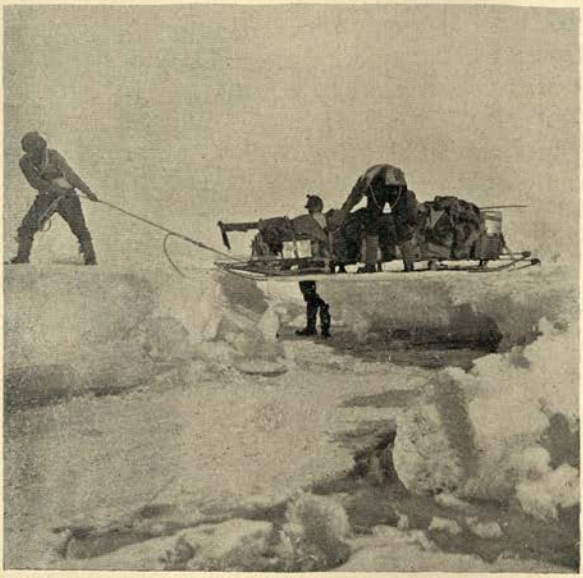
miles from its snout. Its snowfield was very circumscribed, but reached the summit of the bounding ridge in several places. The glacier up here was not crevassed, and the main surface lay only two hundred feet below me. After making some rapid sketches I returned to the snout of the glacier where the others had already arrived.

This Davis valley contains a typical example of the "ice-slabs" mentioned by Ferrar. But I do not agree with his description of them. He writes, "They are the relics of glaciers which once drained the snow valley; but owing to diminution of ice-supply, this has now become an inland basin, and its overflows have slipped away from it, leaving a subsidiary watershed bare."

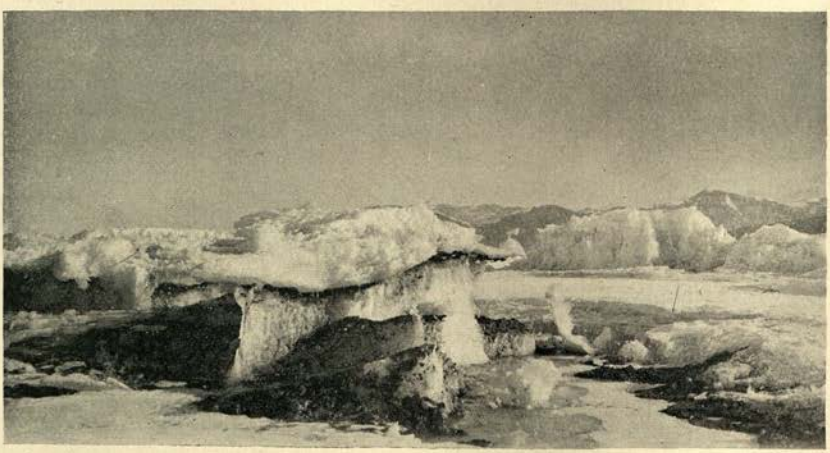
In the first place, the head of this glacier was a typical cwm, with steeply sloping sides, and to all appearance a sharp crest to the ridge at the back. It did not resemble the discontinuous lower portions of the Lacroix and Sollas Glaciers in Dry Valley, which fully deserve the title of ice-slabs. The latter lie supinely, one might say, on a gently sloping hill-side, in which they have cut no definite trough. The method of erosion of these curious valleys became clearer to me as we saw other examples in the next fortnight.

Monday, February 20.—We spent the morning making a depôt on the Ice-Borne Moraines. We left the camera legs with a flag thereon, and cemented them into the gravel by the simple method of pouring a cup of water on to it! The seal's liver we put under the food stacked in the small sledge, and I left a note of our whereabouts in the instrument box. We took eighteen days' food with us.

We crossed about one mile of good surface and then reached "glass-houses," "craters," "pools," etc., through which we struggled till two o'clock. After lunch Wright and I prospected and found some "plough-share" ice about a mile to the south-east. We made for this, having to cut tracks along the bottom of the channels connecting "glass-house" areas. Debenham and I pulled on short traces while the others lifted the sledge over the constant succession of obstacles. The sledge fell two feet into a hole and capsized, but the brunt of the shock was absorbed by the empty oil tins. We were always falling, and occasionally disappeared a foot below the glass-house surface.



TRYING TIMES ON THE KOETTLITZ GLACIER, FEB. 2, 1911.
The sledge has fallen through "glasshouse" ice into a thaw-water channel.



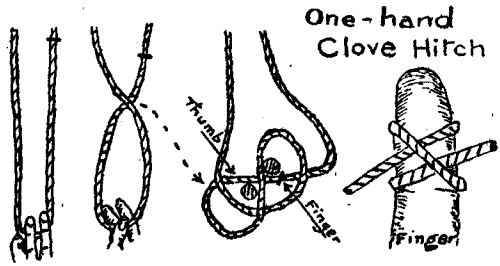
TABLES OR ICE "MESAS" IN THE LOWER KOETTLITZ CUT OUT BY THAW-WATER. [See p. 157.

Later we halted in a slight snowstorm. We were cheered to hear Evans say that it was the worst sledging surface he had ever seen, even though he added that it was not fit for sledges. I wore my iron steig-eisen all day, and so was able to hold my own somewhat; but the others preferred to slip about, for the irons certainly made one's feet very sore.

For an hour we had fair going over "plough-share" and shallow glass-houses, during which we changed direction somewhat to the south. A thick snowstorm blotted all ahead, and we reached a region of "basket-work" ice structures, which we called "fascines," and all sorts of ice tables. One shaped like an Armadillo standing on a pedestal was especially noticeable, and after pulling the sledge over three "roof-pillars" (the roof having long ago fallen in) we cried "enough," and camped in the shadow of the "Armadillo."

"It is fairly warm to-night, the others smoking peacefully. They have almost given up trying to make me smoke. I had a difficulty in getting Wright to eat some extra pemmican! 'Sugar Vat,' 'Liver Chewer,' and 'Pemmican Tub,' are common ekenames. And so to sleep."

During the next four days we struggled up the middle of the Koettlitz Glacier. It was a strenuous time, but I recall a pleasant noon halt when P.O. Evans earned an honest penny. We saw him playing with the rope which lashed his sleeping-bag. Says Evans, "I'll show you how to make a clove-hitch with one hand, and I bet you a 1*s.* 3*d.* dinner (our usual currency) you can't do it after you've seen me do it six times!" Debenham took the bet, and we all watched Evans closely. Then "Deb" tried, and to our joy succeeded, for the handy-man was rarely "done." But he never turned a hair, and booked the bets that now filled the air. Again Debenham proceeded to try, and failed—and Wright and I were equally unsuccessful. Evans made quite a haul, but



How Evans won his bet.
20·2·11

after saying he had never seen any one do it by sheer luck before, he proceeded to teach us the dodge; and later Debenham became quite a knot-master under his willing tuition.

"A fine sunny morning, the first for many days. Even this scene of desolation looks cheerful." Thus my sledge diary for the 21st. But the route did not improve. I wrote: "We got going on awful stuff—rounded pools of ice, between tables. It got worse and worse, and after many bumps and leaps and falls I decided to prospect. We had done half a mile in the hour. . . . We started again about 3 p.m. Awful heavy work over 'glass-house' and leaping three-foot chasms, between high fascines and across decomposing rivers of ice."

About 4.30 we saw a ragged piece of skin projecting from under an ice-table, and found that it was part of a large fish. We spent half an hour chipping it out, and recovered the dorsal spines, skin, tail, and the vertebræ. These were preserved in a yellow fatty substance smelling like vaseline and quite soft. I made rather a ludicrous mistake here. I carefully preserved a very hard irregular mass coated with this flesh, thinking it was a bone, but later, after we had carried it for days on the sledge, we found that this "pelvic bone," as we called it—melted in warm water! No head was found, and in this respect the fish—which was possibly about four feet long—agrees with the four large headless fish found by the *Discovery* Expedition. We had a hot discussion in the hut as to this problem of decapitation, but came to no definite conclusion, for it seemed too far for seals to carry it.

That night we slept at Park Lane Camp. We had been traversing a frozen park, set out in circular beds with winding paths in every direction. The "flower-beds" were represented by elevated masses of ice thirty feet across, exactly like an apple-pie with a raised crust—even to the four cuts made by the housewife across the top! The last two days we had only progressed seven miles, and for five of them we had carried the sledge rather than dragged it.

Next day, however, we found that to the south the glacier was nearly continuous. It had not been dissected by thaw-waters to nearly the same extent, and by 4 p.m. we managed to advance ten miles to the south-west. We camped on a platform of weathered ice, so rotten that it resembled a layer

of honeycomb. We found that this honeycomb ice was very common in this part of the Koettlitz.

We tried to find an easier way out of the numerous undulations which now characterized the surface, but unsuccessfully, and so plugged on south-west. We used to "pully-haul" up one side (*i.e.* hand over hand) and then toboggan down the other. P.O. Evans was an expert steersman, while we others used to keep the ropes clear. But we had some nasty falls, especially Evans, who got a cut deep in his palm from a piece of "bottle-glass" ice, in spite of his thick mits.

At noon we came across a picturesque tunnel in the ice, about three feet wide, seven feet high, and one hundred feet long. It had been cut out by thaw-waters which had now drained away.

In and out wound the lanes, forming a regular network through all sorts of picturesque pinnacles. Here was one like a yacht on stocks, there a perfect wedding-cake twelve feet high, again a lady's bonnet, and so on, in infinite variety.

The long promontories of "bastions" along which we skirted are probably dissected undulations of the original glacier surface, fifty to a hundred feet high. They are all steep to the north, and covered with sloping plough-shares on the south. The bergs which we left ten miles back were like *jumbled* blocks, and were not separated by simple channels—which looks as if they had been floating separately at some period and then frozen together again. This may explain the presence of the sponges and fish which we found so far from any open water.

On the 24th I wrote: "This is the day of my release from the joys of cooking! We have done four weeks. A rotten night, cold, and pillow (of books, etc.) slipping away on the smooth surface. Every one restless. Smooth ice no good to sleep on, though I had a jersey under me. Bright next morning, and we took photos till 10 a.m. Then we made across country towards a hanging valley. Some of the lanes were overhanging, and I took a photo of Debenham and Evans sitting under a ledge. Sheets of plate-glass projecting from low bastions were common, but there was no undulating country. More common were sharp bottle-glass angles sticking up abominably from about eighteen inches to

two feet, and impeding the sledges, while pot-holes (due to the sun eating round black silt) caught one's boots.

"Lunched in this mullock about two and a half miles from the coast. Then on practically straight, making fair progress with Evans and C. S. W. at the sledge, lifting while we pulled. We had several upsets, and the rucksack was jerked off, but the fossil fish has survived so far.

"After a final dash up over steep silt bank between pinnacle ridges (where the sledge balanced rockingly!) we reached a broad avenue between moraines and Stonehenge pinnacles of ice. I went back for my brogans, and fell a frightful 'cropper,' getting a spike in my fifth rib.

"After half an hour or so we plugged on steadily up a beautiful surface for two and a half miles. The moraines were getting bigger and wider, and were now about three hundred yards across. We finally reached a fifty-feet silt 'col,' and had to portage the sledge. It was mighty heavy, and flattened our crampons. Later we reached a *cul-de-sac* among the moraines, and after a survey I decided to make a final camp, as we were now favourably situated to explore 'Snow Valley' and Heald's Island. I don't understand the ice-slabs or the promontory on the 1902 map. I guess it is wrong.

"The sun clouded and snow began. We put the tent in a sandy dell. It was so small that we had the tent like an old sock at the side! However, we are on earth again, and not on cold wet ice, even if one post of the tent is on a huge stone.

"I cooked my last meal. Raisins in excess (× 2), sugar-dust about right, cocoa × 2, chocolate short ¾, cornflour three portions left, cheese short ¾, biscuits right, and pemmican two feeds left. Butter short owing to seal-liver feast. We had a good hoosh and drank thick chocolate.

"My week's cooking done, Praise Be! 9.20, snowing now and pretty cool."

Next morning was devoted to a "make and mend." All our sleeping-bags and finnesko were wet with the sloppy ice-floors of the last week—for we had not been able to find any snow-drifts on which to camp. They are much warmer and drier than ice.

Behind the tent to the north were slopes about 1000 feet

high leading to empty "hanging" valleys. These radiated from the base of the Lister scarp, which rose in one steep face 10,000 feet to the summit. This face was pitted by gigantic "armchair" valleys or, as they are technically called, cwms, and presented a spectacle which probably could be paralleled nowhere in the world.

Looking southward across the Koettlitz from the mouth of one of these hanging valleys one could see some sort of plan in the icy maze which had so bewildered us. Above Heald Island the valley was filled with the glacial stream in a normal uniform mass, interrupted only by crevasses and falls. But to the east of Heald Island it took the form of a glacier "delta." Below the falls the ice descended to the east in a series of broad undulations, a portion of which we had traversed on the 23rd. Long promontories of ice fifty feet high extended from the unbroken glacier mass and probably represented the crests of the undulations. These degenerated at the ends into icebergs and monoliths of ice, and these again had weathered into the bastions and pinnacles. Lower down the thaw waters had etched these into still smaller units, and along the coast just below me the streams had formed a well-defined if narrow avenue of smooth ice, which promised us an easier return.

On these slopes I found an ice-scratched block—the only specimen I had seen in a hundred miles of moraine debris.

I walked along the margin of the glacier, and was amazed to see seal-tracks in the fresh snow. We were over twenty miles from the sea, and had not seen any possible route for seals on our outward journey. Yet here were two seals—asleep as usual—on the old glacier ice. I disturbed one of them to see what it would do. He sneezed and grunted at me. When I teased him further he began to warble! I heaved a lump of ice at him, whereupon he lolloped twenty yards to a wet patch, lay over on his side, and produced a whole octave of musical notes from his chest, ranging up to a canary-like chirrup. Finally he crawled under a deep ledge, and vigorously butting with his shoulders, opened out a hole and flopped under the avenue ice.

Later I came out among the moraines, and was unable to make out where our tent was. Soon I saw Wright's foot-prints in the snow—two sets, one going each way. By

Sherlockian logic, I decided to follow the shorter-pace footsteps, judging that the weary owner would walk with less "vim" returning, and they seemed to be "slurred" also. Finally, a mile ahead I saw some skua gulls wheeling about, and sure enough below them I found our tent.

When I reached camp I found that Wright and Debenham had both met parties of seals. We all thought of the constant stream along the tide crack by our last depôt, and came to the conclusion that this was largely fresh water, and formed the main drainage of the Upper Koettlitz. By this sub-glacial stream the seals penetrated nearly thirty miles inland up the Koettlitz Glacier.

February 26, 1911.—It seemed advisable to take the sledge as far up the Koettlitz as we could without waste of time. So we portaged all our loads out of the *cul-de-sac* over a moraine col and so reached the outer margin of the low level moraine, where another avenue of smooth ice ran parallel to the Grand Canal which we had been using. About two miles to the west we passed a seal and its hole. Soon the pinnacle ice came in so close that there was barely room to squeeze in between it and the moraine. We had one spill within a few yards of our final camp, and unfortunately it resulted in the destruction of the focussing screen of my camera. In a sheltered bay among the moraine heaps we pitched our furthest camp, where we remained four days.

About 2.30 we started for Heald Island, which lay three miles to the south across a tumbled sea of ice practically impassable for sledges. (This island is placed too far to the south on the *Discovery* Map.)

First we crossed the definite line of high pinnacles which extended almost continuously for twenty miles parallel to the coast. This we called Stonehenge structure, for many ice masses strongly recalled the Druid monoliths. Then over a comparatively level area of honeycomb ice between low bastions. Finally we reached wide level lanes with a thirty foot wall on the side facing the sun, while the opposite wall sloped much more gently and was fretted into plough-shares.

Looking back towards our camp we were facing north towards the sun, so that we saw the *sheltered* side of the moraine heaps. The whole surface seemed to be snow-covered. Yet from the opposite aspect the moraines seemed

to be bare. I expected this constant thawing on one side of the moraines would have resulted in some asymmetry in their shape, but I was not able to detect any such characteristic.

We had not much difficulty in traversing these lanes, and crossed several cols, down which Debenham and I—who were not wearing crampons—had to slide in somewhat undignified positions. Here we separated, Wright and Evans making for the lateral gully north of the island, while we moved more directly for its eastern face. We had been steadily rising up the lanes and came to the divide near to Heald Island. Here a narrow water-cut channel led down to a broad frozen river 100 yards across, which fringed the island on the east.

Debenham collected along the slopes while I pushed on to get a summit view. This end of Heald Island was 1100 feet high, and the slope was very steep, for the most part reaching 30°. It was covered with a talus of schists, limestones, and basalt, the latter being erratic, while the former were *in situ* on the top of the hill.

I got good views of the topography from the comparatively flat top of the island. The surface was scraped fairly smooth by glacial action, and only a thin veneer of basalt rubble was present in this eastern portion.

I carefully noted the features towards the S.W., and was satisfied that the slope glaciers (Walcott, Ward, etc.) headed in sharp ranges 6000 feet high, which joined to the scarp of Lister without any intermediate longitudinal valley, such as was indicated on the 1902 map as "Snow Valley." The surface of the glacier through which we had passed was very interesting. I could now see that it would take days to get the sledge up the glacier to a spot where our view would be materially increased, and judged it better to investigate fairly fully the features in this interesting region of the valley.

The island evidently blocked the glacier greatly, for this was 700 feet higher on the south-west face than where we had crossed it.

Next morning was foggy and cold, and there had been snow in the night. We boiled the hypsometer and found that the camp was only 100 feet above sea-level. At 11 a.m. we started off to explore a large tributary glacier which we could see across the low-level moraine. Debenham had a sore heel, due to the deep ridges which developed in our frozen

ski-boots, so that he did not move far afield for the next day or two.

After crossing two miles of moraines we reached a lake. It was drained by a stream which ultimately reached the pinnacles of the Koettlitz glacier.

Between the ice cliffs and the lake this stream for a considerable distance flowed under the moraine, and ultimately entered the seals' sub-glacial stream and so reached the sea. Coleridge's lines entered one's mind:

> "Where Alph the sacred river ran
> Through caverns measureless to man
> Down to a sunless sea."

So we christened this stream the Alph River.

We marched along the lake and up the gully beyond. Here a tributary entered from a large cave in the moraine wall to the north. The roof of this cave was coated with most beautiful ice crystals, which resembled pine twigs in shape and were about two inches long. Many brownish ice stalactites and stalagmites fringed the walls of the cave, and Wright was lucky in obtaining some beautiful photos of these structures.

At 4 p.m. we reached our goal—the steep face of the Walcott glacier, but as the weather looked stormy we had to retreat immediately. Wright and I compared compass readings here. The needles swung extremely sluggishly, but we found they were reliable to four degrees—which is about eight times the ordinary error. The fact that magnetic south was nearly due north also complicated matters here! We marched back by a different route and discovered a strong outcrop of basic lava about fifty feet thick, which was rich in olivine and had caught up fragments of garnet rock in its passage through the earth's crust.

It was a cold cloudy morning on the 27th when we started off for a tramp over the ancient low-level moraines. We could see a big tributary glacier about twelve miles away, whose vertical front was separated from the Koettlitz by two miles of bare moraine heaps. Debenham, with his bad heel, stayed around the camp where there was plenty of collecting.

We went a short distance along one of the moraine avenues. Then we climbed eighty feet up and proceeded

over the more or less level moraine debris for two miles. There we came on an interesting outcrop. It was very unexpected to find a deep gully 100 feet below the general surface with water still flowing in the creek at the bottom. The walls were largely composed of ice hereabouts, and they were melting merrily in the sun.

This stream originated in the lake which we had seen a day or two before, and we reached it *viâ* some beautiful meanders. At its outlet was a cave twenty feet deep cut in blue ice.

Evans and I had a bet as to the length of the lake, in which I recorded a win; but "Taff" usually came off best in these encounters!

February 28, 1911. — We awoke to foggy and cold weather, which was unsatisfactory, as one of our chief objects was to climb a peak and get a good view of the hypothetical Snow Valley (between Descent Pass and the Walcott Glacier). Wright and I went back to Alph Lake some miles to the west, while Evans and Debenham made another journey to Heald Island and traversed it almost to its western end.

I investigated the cave in the silts at the lake outlet. The cave seemed to be due to a block of ice breaking away at a silt band, for the roof was filled with stones, while the mass above was clear ice. The interest lies in the fact that these silts were obviously laid down in water, and the large boulders arranged in uniform layers indicated that a strong current had been operating.

I left Wright at the lake, which he crossed later to examine the "crystal cave" we had seen previously. Meanwhile I climbed up the steep delta of the stream leading to the "Ward Hanger," and visited the latter valley.

This gully was about a mile long with steep sides sloping thirty degrees at first. I made for a black exposure which I could see ahead where the gully cascaded down from the hanging valley. This was a bed of decomposed basic lava, about twelve feet thick and pointing to fairly late volcanic action.

Then I proceeded up the gully, scrambling over large rounded boulders. I hurried to the top of the slope and found that a very definite dam blocked the hanger, just as in the adjacent valley. These dams were, I think, high-level

lateral moraines left by the Koettlitz glacier, and not *terminal* moraines of the small tributary glaciers. I could see that the latter (Ward) glacier now lay about five miles up the valley, and resembled the others which we had observed previously.

Wright and I then traced the Alph River from the lake down to the glacier opposite Heald Island. We had to climb over several rough barriers of silt-coated ice, under which the stream flowed. The relative movement of the frozen surface and overhanging ice-cliffs led to very queer twists and bends in numerous icicles, thus forming a striking example of the plasticity of ice.

The water was flowing strongly with musical gurgles under a lace-work of crystal-edged ice. We got very wet boots by slipping through on our walk at the foot of the steep slopes fifty feet high. The river ended in a little round lake separated from the Koettlitz by the silt-covered pinnacle described previously.

We walked along the glacier edge towards the camp. At one spot the water was welling up through holes in the ice, and appeared to indicate a slight tide, for it had spread out to varying boundaries at various times. Probably a variation in temperature would account fully for the difference in supply.

We reached the tent about a quarter past six.

The weather had been dull, and it was useless to expect a good view of the western scarp and valleys. I decided to wait until the 3rd if necessary to climb up for this view. The hills were now snow-covered, and we had several valleys to the north to investigate before our return.

The month of March opened with a bright sunny morning, just suited for our proposed climb up one of the hinterland ranges. We climbed up the slope about eight hundred feet and soon reached the level floor of the hanging "valley" just behind the camp. We marched along this to the north end of the valley towards a prominent peak on the eastern ridge. A stiff climb over snow slopes and rugged granite led to the summit, which we reached at 1 p.m. The aneroid made this 3000 feet above sea-level. It was a beautiful day and we could see Erebus, Discovery, Morning, and the Pyramid up the Koettlitz. Lister itself, as usual, was in the clouds, but nearly all below was visible. We could see numerous hinterland ridges reaching from the Lower Koettlitz to the Lister

scarp, and satisfied ourselves that no lateral "Snow Valley" existed below the scarp such as has been indicated in earlier maps.

It was very cold on this hill (which we called Terminus Mountain); and after swinging the theodolite and taking several photographs we hurried back to the tent down Ward Valley.

On March 2 we started our homeward trek; nothing could be worse than our outward track up the middle of the glacier—though we were able to study the changes of the glacier ice and so did not regret it. I therefore decided to hug the coast on our return, though near the depôt the ice was so full of silt from the moraines that we had not seen any feasible route along the coast thereabouts.

For the next few days we followed the course of the sub-glacial Alph River. Some four miles down-stream from Terminus Camp a rampart of ice pinnacles commenced, which recalled the monoliths of Stonehenge. These walled off the rough sea of the Koettlitz Glacier from the frozen surface of the "river." This broad lane was here a quarter of a mile wide and consisted of a level surface broken up by deep sunken "paths." The more elevated areas were preferable for sledging, for the paths occasionally let us through into water. The whole structure was due to the drainage of water away from rivers and lakelets whose surface had frozen.

This splendid track—which we called "Alph Avenue"—enabled us to proceed with unexpected ease, and each day we halted and explored one of the numerous tributary valleys which characterized the hinterland.

Each valley was of the same type. A great bar of debris, some three hundred feet high, blocked the mouth of the tributary. Within this was a bare rounded valley extending to the foot of Lister. Some five miles from the coast was the snout of a tributary glacier which had originally deposited the moraine, but now was shrunk back to a mere shadow of its former self.

All along our route were groups of seals, and numerous skua gulls enlivened the surroundings. Coming back from one of our détours I was much amused to see Wright crawling about among the seals in his investigation of the ice—while thirty skuas were anxiously awaiting the demise of this obviously crazy seal!

The summer was over now and we were getting fifty degrees of frost in the nights. The weather was gloomy, the sun rarely appearing till it had sunk below the level of the pall of stratus.

We had an eventful lunch just before reaching our depôt. We pitched the tent and fastened the door to keep out the wind. I was sitting next the door with my precious lumps of sugar on the floorcloth when I noticed that water was creeping into the tent. In a few seconds it was several inches deep. We bolted our raisins, pocketed the lumps of butter and sugar and rushed out with the sleeping-bags. There was a small lake all round us, rapidly rising round sledge and tent. The water was rushing out of a crack one hundred yards below us, probably driven back by a high tide. We had quite a pilgrimage to get our sledge packed again, having to walk round the newly formed bay.

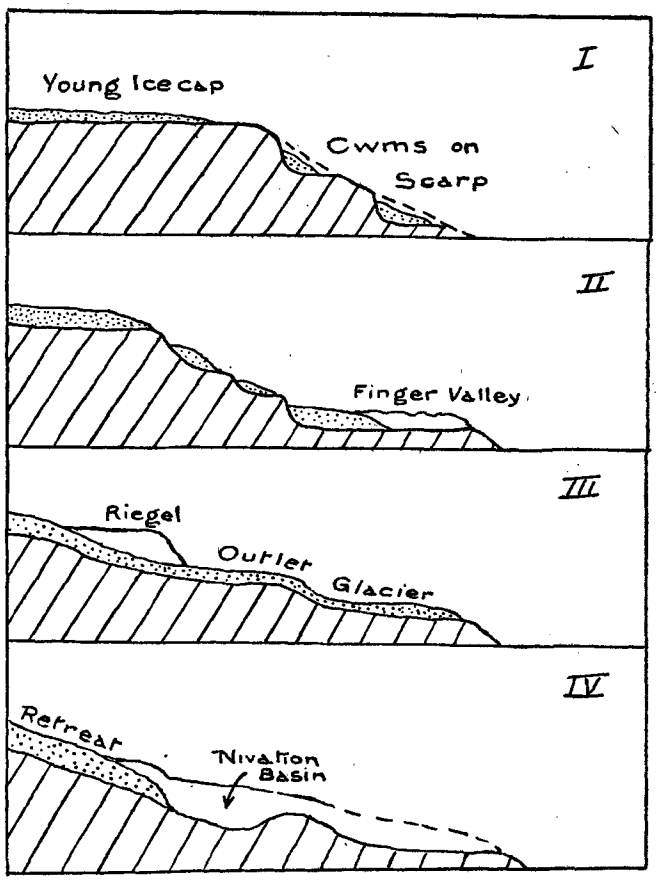
The avenue petered out here, after furnishing us with a magnificent highway for twenty miles. We had some pretty rough work for the next mile or so, but reached our depôt safely on the evening of the 5th.

Having now described many of the glacial valleys it is interesting to see if we can discover how their peculiar topographies have arisen. One great problem confronting geologists is to explain how the giant "steps" and "basins" of the Swiss glacier valleys were produced. In Antarctica the *gradual* change in the character of the valleys as we proceed northward from Mount Discovery has led me to put forward a theory which I think holds good for these huge glaciers in latitude 78° S., and may help to explain those in 45° N.

In old Greek manuscripts one can sometimes discern traces of an older script half obliterated by the later writings—this MS. is called a *palimpsest.* Just so in Antarctica—I think that beneath the largest *outlet* glaciers, such as the Ferrar and Taylor Glaciers, we can perceive the relics of an earlier *cwm* erosion.

Near Heald Island is the gigantic scarp of the Royal Society Range 10,000 feet high. Cutting into its face are simple cwm glaciers such as the Walcott glacier. This stage is shown in section I. As the snow accumulates (and turns into ice *in situ*) we get a gnawing process, in the moat, etc., at the margin of the glacier, which gradually extends

backwards and eats out a long parallel valley such as the Davis Valley (section II). If the plateau ice-cap increases sufficiently it will drain to the sea as an *outlet* glacier. This will obviously



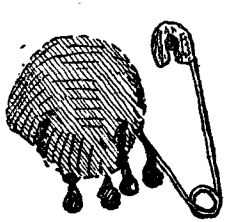
The "Palimpsest" theory. Generalised sketch sections, showing the chief types of valley erosion. I. Early erosion like that shown by Walcott Glacier, 78° 10′ S. II. Headward erosion producing a "finger" valley, shown by Davis Glacier, 78° S. III. Plateau ice overwhelming the cwm glaciers giving profile like the Ferrar Glacier, 77° 40′ S. IV. Pronounced erosion by "thaw and freeze" (= nivation), as shown in the Taylor Valley, 77° 30′ S.

tend to follow the lowest contours and so would naturally overwhelm a series of cwm glaciers (such as shown in II). Hence we get a glacier falling over steps (and cutting gradually

through them) which were originally heads of cwm valleys (see section III). Finally, these big glaciers may retreat very slowly, and at their snouts—in a somewhat complicated way which I have explained elsewhere—further erosion by nivation will produce basins with level bottoms, such as those in the Taylor Valley * (section IV). In the maximum of glacier flow (for which we have to go to temperate climes for good examples) there is much "planing" by the glacier, but not in Antarctica under the present conditions. At any rate, the conclusion I have reached after two summers' sledging, is that considerable frost, wind, and water action is occurring in the Ross Sea area, and very little true glacier erosion. Moreover, the gradual succession of types of valley erosion which we investigated makes me confident that some such cycle of evolution as sketched above is not only possible, but has taken place in the south.

On arrival we swept the snow from our old ground and camped on the bare gravel, for our floorcloth was quite soaked. I went over to the seal I had killed a fortnight earlier and managed to cut through the frozen hide. Evans and I then managed to prize off some blubber with the spade. The blubber was quite soft where it was protected from the air. Evans and Wright were frankly sceptical as to the value of blubber as a means of frying!

"After cleaning out the aluminium base of the cooker, Debenham cut the blubber into strips and heated it up. It soon began to melt and gave off much steam at first. The smell was like fried herrings and not unpleasant! We had thawed out some liver from my cache, and at + 2° F. it was as hard as iron! I cut it into strips and we cooked it in the blubber for a quarter of an hour or so. Debenham tasted it, and then I ate the first piece.



Forks for Blubber 5·3·11

"Jolly good! Absolutely no taste of fish or oil, which was curious in view of the smell of herrings. Evans took his bit gingerly, and then handsomely acknowledged that he had been sold. He reckoned their

* The theory of *nivation* would be out of place here. It is explained in Hobbs' "Existing Glaciers," and I deal with it fully in the official memoir.

cook had tried to poison them in 1902. We used safety pins as forks, and my bowie knife to turn it over. A vote of thanks to Deb was passed by the company!

"With luck we shall camp in the middle of the Dailey Isles to-morrow (Monday). On Wednesday get to Hut Point, and then two days to Cape Evans."

This prophecy was rather feeble! We took nine days to reach Hut Point, and five weeks elapsed before we saw our own headquarters!

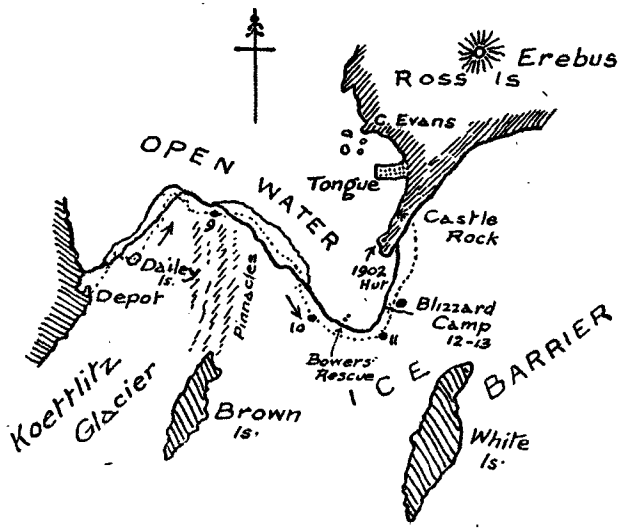
March 6, 1911 (*Monday*).—A fairly sunny morning with a temperature of −8° at 9.30. We spent some time in packing all our depôted goods. I carried an empty biscuit tin to the nearest large moraine heap, and buried it halfway in the gravel with a note of our journey. The sun, glancing on the bright metal surface, made this a very distinct landmark some distance from the moraines.

We had now two sledges to pull, but the surface was very good. We made for the nearest Dailey Island. After one and a half hours we reached old ice at a higher level than the sea-ice we had just left. Here I mounted a hummock and saw that open water extended to Davis Bay, and was practically within one mile of our track. We were rather astonished, for this ice (around Blue Glacier) had not been out for several years. We pushed on and camped two and a half miles from West Dailey Isle for lunch. Another two miles brought us to a most interesting locality. All around us were heaps of large sponges half buried in snow and ice. The three largest heaps were about 8 feet long and one and a half feet high. The sponges were a foot in diameter, and among the long spicules we found Bryozoa, Brachiopoda, Serpulæ, Molluscs, and a fine solitary coral.

How did these marine animals come to be entangled in the old ice on which we found them? The ice was apparently normal fresh-water glacier-ice, but may have been originally sea-ice from which the salt had drained out. At any rate, it was floating—for half a mile further east was a succession of grinding ice-cracks. I believe the sponges were pushed up (from a depth of twenty feet or so below water) by the edge of the Koettlitz glacier, in some palæocrystic age when its snout was much less advanced.

We pushed on about a quarter of a mile, and reached

irregular ice crossed by a deep gully due to tide cracks. Here we left the sledges, and all climbed up the West Dailey Island. We attacked the nearest snow-covered slope, though later we found it was the steepest portion of the island. There was a fair route along the snow, however, and we soon reached the top. Two asymmetric valleys crossed the island, whose cross section seemed to indicate glacial erosion from the south-east. Blocks of marble, kenyte, and gneiss were scattered over the island, which was itself composed of basic lava. We were most interested, however, in the view towards Erebus, for we hoped to see a clear route to Cape Evans.



Map showing our journey round the breaking barrier.

Four miles north of us was a prominent crack leading east and west. All the ice to the east and north-east was rough, pinnacled stuff as far as we could see. In the distance Inaccessible and Tent Islands appeared clearly, and also a curtain of frost smoke. We could not detect the latter much south of Tent Island, and hoped this meant that the ice had not gone out behind Glacier Tongue.

I decided to camp after another mile, and then skirt along the pinnacle (bearing towards Cape Royds) until it appeared feasible to cross to the east. I photographed the little valleys on the island, and then we returned down a much easier slope

to sea-level. Here we saw a young skua practising its first flights under the eye of two older birds.

We camped in the snow amid troubled ice just off the north-east corner of West Dailey Island.

March 7, 1911.—We had a wakeful night, for the pressure ice at 2.30 started groaning and creaking just under our heads. We had a temperature of −13°, and the night was quite dark, though a glow was apparent to the south. In the morning a cold wind from the south-east arose.

I had to prospect across half a mile of bad surface, but found a fair route for a single sledge before the packing was concluded. The sledges stuck badly on sharp snags, and we had to relay through tables and over snow-covered ledges and crevices. Then we reached a glass-house surface, which was fairly stable owing to the thick covering of snow. We held along the west side of the broad tongue of bad ice and made fair progress. It was pretty cold, however, and Debenham suffered two frostbitten toes.

About 4.30 I felt that we ought to be near the end of the Pinnacle Ice as shown on the map. So we pulled towards it, and reached high ridges rather suddenly. We camped here, and Wright and I penetrated the ice for a mile, making for a specially high pyramid. The surface was frightful, consisting of big rough undulations much broken into snags and pyramids, and crossed by frozen rivers with window-glass buried in snow-drifts. We could see no difference in the distant east. It was evident that we could not cross here, and must make still farther north. We felt that the whole broad tongue had moved north. It was necessary, therefore, to turn back and go rather to the north-west. Hence we called this Keerweer Camp, after the Cape Keerweer where the old Dutch captain retreated from Australia.

March 8, 1911.—We moved off along the edge of the pinnacle to the north. We did about one and a half miles, and got bogged in bad country. A prospect ahead showed that we had entered a sort of *cul-de-sac*. We could see frost smoke rising all around us, and heard seals; and, apparently, orcas blowing and grunting, much closer than we could explain, for we could see no water. Finally, we decided to keep to the smoother ice, and so for the next mile or so were heading for Butter Point, directly away from our destination at Hut

Point. Soon we turned more to the east, and topping a small rise, were confronted by a large bay of open water in the pinnacle ice, in which several orcas were apparently enjoying our discomfiture. The water lay right across our path, and we made as rapid a course as we could lay for the further side of the bay.

Before going many yards into the pinnacle ice we came on a labyrinthic river of salt water fifty feet or so below the general level of the pinnacle. Luckily the pancake had jammed in this valley, and it was strong enough to carry the sledges. We had to haul up the sledges by hand on the further (southern) side. Here we lunched, and soon after came to a fifteen-foot drop, which necessitated casting off one sledge. I prospected ahead, and the other three followed almost as quickly as I could pick out a feasible route. Every now and again I climbed a pinnacle, and got a fair view, and so we got along much more easily than I had anticipated.

The grade was good, but necessitated much winding about, and very often drifts of sand covered the ice and played havoc with the runners. The drifts of snow, eighteen inches deep, were no trouble compared with a thin film of sand on an ice ridge.

We could hardly get a fragment of ice hereabouts which was not full of sponge spicules, which did not improve the hoosh. It was very curious to see the skuas pecking at the numerous sponges lying around, while they neglected the small frozen fish (Notothenia), of which I saw a dozen!

By six o'clock we brought up our second sledge to the site I had chosen for a camp. Just north of the camp was a large cavern excavated in the side of a thirty-foot cliff by a meandering river, now frozen. We had a fairly sheltered position for the tent, but there was no snow for the flaps. However, ice blocks made that all secure. Before turning in we took a round of angles, which should fix the position of the edge of the open water quite accurately.

March 9, 1911.—A comfortable night, the temperature only falling to −3°. We picked a pretty fair route across the meandering gully. At one place a snow-drift had built up a track above the undercut edge of the river. Then we went down-stream a quarter of a mile, and then hauled the sledges up the further bank. We could see quite a large

patch of smooth snow towards Observation Hill, and made in this direction. As we were not more than sixty feet above sea-level, I judged this to be four miles off, which turned out to be the case, though it took us nearly two days to reach it.

We pulled in relays, doing one and a quarter miles with the light sledge in less than an hour, and then returning for the heavy sledge with some knowledge of the conditions ahead. Twenty-five minutes took us back to the other sledge, and sixty-five minutes more with the heavy sledge brought our whole equipment one and a quarter miles nearer Hut Point.

Bad sandy patches still annoyed us, but the ice was gradually becoming more level as we penetrated further south. In the afternoon we did a longer relay, with less sand but more snow. We had to cross several creeks, and had some upsets, but at the end of our day's work a climb to a pinnacle showed up smooth sea-ice no great distance ahead in the direction of Tent Island. Six hours' hard work—largely hand-hauling—had only given us three miles of progress. However, we were able to enjoy the chocolate provided by Evans in honour of his own birthday, and we christened the camp Birthday Camp in consequence.

I feel that I cannot more fittingly describe the last few days of our First Journey than by transcribing my sledge diary. The style is "choppy," but if the reader will picture the conditions under which the journal was written he will perhaps excuse lapses. We were now coasting the breaking Barrier edge, just where Bowers's party had gone adrift a week before (see p. 197). It was getting very cold, and we had been sledging six weeks—over really awful surfaces since mid-February—and were feeling stale and in need of some comfortable rest at night.

". . . *Friday, March* 10.—I am writing this on the morning of the 11th, after a rotten night. The tent is flapping and C. S. W. wears a worried look as the icy aluminium pot sticks to his finger. I have filled the cooker with powdered snow. There is drift everywhere, an eighth of an inch thick in C. S. W.'s bag, who got out to survey the scene. I have a blistered ear, and am wet everywhere owing to perspiration. There is no joy in us, though sounding merry. I slept on the outside, where Debenham has slept hitherto. However,

I could get my back warm against him, which is not the case when we reverse!

"We moved off about 11 a.m. with the light sledge. Debenham prospected one-third of a mile, and then returned to say that we could go on with both. So we pulled up the heavy one, and in less than half an hour reached the level ice, about 11.45. Hence we traversed about six miles of pinnacle ice. We had heavy going for a mile, owing to deep snow between hard patches, occasionally knee-deep.

"Now a long argument arose as to the course. Debenham wished to head straight for Glacier Tongue, and reach Cape Evans same night maybe. I judged it not much further to Hut Point, and we were rather near the sea edge. Evans felt frost-bite in toes, but said later it was due to chocolate-paper stuffing!

"We camped for lunch at 1 p.m., with good hopes of getting all 'sprowsy' by night. The others put on finnesko, as all very cold. My feet troubled me least of all. Good ho! so I didn't change from boots, though blisters very raspy when one's foot slipped into a deep crack! Left about 2.30 and surface got much better—patches of hard white snow and some ice. We decided to get to Hut Point or bust! About 5 p.m. we decided to bust, for there was apparently five miles of open water before the Hut! So we deviated with what speed we might to the south, gradually veering further south in the teeth of a young blizzard, which made much drift and at times obscured land. We donned coats and windproof, and during the last hour got very wet with sweat. Rather tired when at 6.30 we stopped near snow-drift, being four miles from the sea.

"We had to put up the pole first and then the tent, which nearly blew away, and the floorcloth afterward. I got into finnesko and got fairly warm, though the primus went out several times through draught, etc. Huge blocks of snow on flap. Rather slow prospect of a week or two at Hut Point, when we felt yesterday pretty sure of getting to Cape Evans in two days! Wind moderated at intervals in the night. Good sunset and fairly clear, so this is not a true blizzard.

"*Saturday, March* 11.—Fairly clear, still some snow-drift and gusty. Up early. Every one uncomfortable in the night. Hope to reach the Hut *viâ* Pram Point about 4 p.m.

"Drift packed hard round the tent, and had to dig out it and sledges.

"Made an early start at 9.45 a.m. Saw mists rising apparently all way from Hut Point to White Island. One column of dark cloud very persistent, the rest varied with wind somewhat. So we made for east centre of White Island over poor surface owing to fairly soft snow.

"Finnesko nice and warm, felt as if one's feet bare after boots. We did six miles and camped where we seemed to see the crack petering out. Then two miles in the hour to (3.45) where we deviated from White Island. Here Castle Rock was occulted by Observation Hill. I thought end of water would be only three-quarters of an hour away! We saw a black dot and cairn of snow and decided it was the Barrier depôt.

"We had crossed one crack, probably an old one. The depôt turned out to be a fawn-chested seal, active and bold, which moved off rapidly (4.30). (The open water was here only half a mile away.) The cairn was pressure icé, probably old line of permanent ice. About a mile further came on sledge tracks of *depôt* party.* Don't see their depôt anywhere. Not possible it has gone out, as undoubtedly some of Barrier has. At 5.30, after doing about four and a half miles, we reached southern end of broad bay of water.

"C. S. W. took photo here, but so cold that spring shutter didn't work, I fear. Then on for two miles further to our Barrier camp.

"*Sunday, March* 12.—Rotten night; slept about four half-hours and shivered, sore ear, cold knees and back, everything wet (on outside). Helmet a mass of ice, and so wrapped my head in wind-proof pants. Others better. Dreamt six individual dreams, including our relief by a rival party of kids! I got up to read aneroid and so acquired merit!

"Primus a great bother in the morning.

"Quite foggy and snowing considerably. Not safe to say where we'll be to-night!

"We left about 10. Foggy everywhere and drift blowing, but could see sun. Went (S. 40° W. magnetic) for two miles or so, then steered by sun. We saw a black object on

* These tracks were made by the Rescue party, in their attempts to save the ponies, ten days earlier.

ahead. Evans said an icefoot; I said boxes. They turned out to be bales of fodder nearly covered and an empty dog-biscuit box. From here tracks of five sledges (no ponies) lead to Pram Point. We piled up fodder higher, and left map and note tied to our depôt pole.* By this time wind getting stronger.

"We marched on over undulations, mostly heavy going. Wind from the south-east. About 11.30 a.m. followed sledge track right to a narrow gulf leading into Barrier, with broken block sticking out. Ice twenty to thirty feet above water, some snowy, new ice in the open gulf (elsewhere all clear water). The shore went nearly due west from here. We crossed a strong crack rising several feet. C. S. W.'s foot went in here. I deviated to north-east from here, and pulled three-quarters of an hour in worse wind and drift. Camped at 12.45, about four miles from main edge and one and a half from crack (and edge). Very blowy and blinding, and cold. Had lunch and no better! Stayed in tent, and here we are held up indefinitely only six or seven miles from the Hut! We tried dancing to warm feet. Played cards, sang, changed socks. Finally, about 4.30, all went outside and filled cooker with snow. We decided to have an early supper and turn into our wet bags. We lit the Primus, and let the flames singe our feet to warm them. Talked of Cambridge cake and tea and other delights. I put on pyjama pants for the first time. It may prevent chills to-night, but I doubt it. Evans told cheerful tale of snow wall round tent at Cape Crozier, when they were pinned in for five days in September in 1903!

"We can't see a hundred feet anywhere. The rime is dripping down my neck and covering our bags. Drifts are slipping off the tent. Wind veering somewhat southerly from south-east. Now and again we peeped out of doors. No improvement. Couldn't get into shore probably to camp, as water is evidently exceptionally far to east. No camping on slopes, I understand, and daren't try to reach the Hut (eight miles or more round) in this damned young blizzard. Guess we'll shiver it out. Underpants make much warmer, but toes nearly as cold as ever. 5.30 p.m. Booming of lid of biscuit-tin outside is like Inchcape Bell."

* The other parties had all returned from the Barrier a fortnight before to Hut Point.

[N.B.—13th and 14th written later in Hut.]

"*Monday, March* 13.—Pretty miserable all day. Stayed in bags till 10 or so. Tent flapping wildly. There had been a lull in the night; slight shift to south-west at times set the door swinging. Couldn't get going at all. Had lunch at 12 (no breakfast). I didn't like the idea of Barrier edge being only one mile away, and we are on a bad crack; but as thirty feet cliff, probably ice is eighty feet thick. Couldn't see the sun all day till late in the p.m. Evans told yarns as usual. We had supper about 5 p.m., after trying a melancholy game of Rickety Kate, in which we couldn't deal in mits, and got frost-bitten if we took them off. I managed to read a bit of "The Great Plot." C. S. W. cursed baccy, and Deb lay low and felt cold. We turned into the bags very early, though the sun appeared about 5 p.m., and could get a sight of land above the drift.

"Evans said curious wind never to south-west, and so *not* a real blizzard.*

"*Tuesday, March* 14.—Another night nearly as bad as the previous, with sore backache added, for everything damp. Used to put head and all inside bag for ten minutes and *hot* up bag. Then open nose hole to get oxygenated again!

"We got up at 7 a.m. and had early breakfast, but it came on very badly about ten, and as we knew directions we decided to make for Castle Rock anyway within half an hour. We dug out sledges and the tent flap. A long lee snow slope lay a hundred feet to north of sledges. Instrument boxes and tank full of drifts of snow, of course.

"Bags thrice proper weight. Mine worse split than ever, so I have no hood now. We marched on rather difficultly, but wind helped us considerably over small sastrugi and drifts. Helmets tight over head, but *under* chin† (*i.e.* not coldest). All our duds on—a mistake as one gets so sweaty and it is tiring. Went on and on. Could see ice bluff on left, passed it and approaching slopes. Wondering if we'd have trouble at the tide cracks, which Evans described. All lost to sight in fog about 1.30. Plugged on steadily, had hallucination of hawthorn trees just behind one. (Why?) Told C. S. W.

* His meteorology was incorrect.

† In the coldest weather the helmet covers the chin and a nose-nip protects the nose.

we were ascending, and wondered where the tide crack was. We had steered for the cone all the way to reach the incline as used by Evans (day of Vince disaster, 1902).

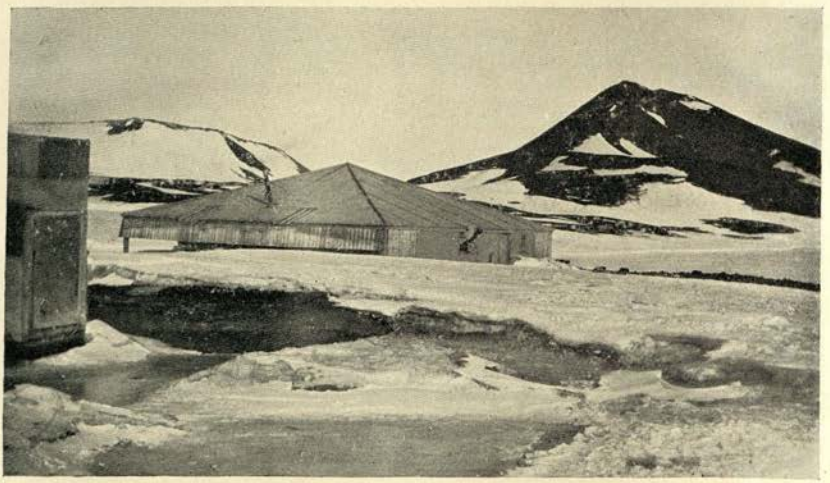
"Just about 2 p.m., I guessed we were over the tide crack, and the sun appeared and showed us we were one-third way up the mountain! So we joyfully had lunch in the strong wind. Then transferred all necessaries to the big sledge (including ski boots), and left about 3.30 for the climb to Castle Rock. Not half so bad as expected, steady pull up eight degrees (about four miles), only two stops. Reached the top at 5.30, without trouble except for some slipping on hard snow. We zig-zagged a bit. Castle Rock is composed of agglomerate with brownish outer zone, over a darker centre. Height about 150 feet (boss). We had a short rest. A very strong wind blowing across us now. Evans evidently had Vince in mind, and wouldn't let us pull quickly, though on a broad platform. We saw here a team track, apparently a dog team with sledgemeter. We had arguments as to its meaning and decided only one unit back. C. S. W. reckoned all the ponies 'gone under' as no tracks. Plateau one and a half miles long and one thousand feet high. Then we saw four men over towards Crater Heights. A great sight, though comic, to see arms swinging and fat wind clothes. Not like Penguins! They came towards us. We guessed the names all wrong, except Birdie. (They were Dr. Bill, Atch, and Cherry.) We heard all were safe and back, that the queer tracks were due to rescue of Bowers, Crean, and Garrard. They took our sledge down Ski Slope. Dr. Bill said, 'Go and see the Owner.' They were just expecting us. I put on crampons and met Scott. He told me of loss of ponies. Of the eight, three died in blizzard, three lost on floe, so only two left. We got to the hut about 7 p.m. Found it all cleared out by Atch and Keohane; very dark and sooty from the blubber stove. Only one lantern, we sat around; and pots served out in fixed order. Owner arranged for us to sleep in the 'Sanctuary,' opposite window. We had one lantern over stove, and then turned in to wet bags and slept fairly. Gran gave us finnesko. Will get Gran and Garrard's yarns after."

IV

A MONTH IN THE OLD *DISCOVERY* HUT

March—April, 1911

ALPH RIVER CUTTING THROUGH THE MORAINES AND ANCIENT ICE. [See p. 170.



"DISCOVERY" HUT, JAN. 25, 1911.

Showing the ice-slope above the bay leading from the Gap to the Hut. Note the eaves of the hut on left.

A MONTH IN THE OLD *DISCOVERY* HUT

WHILE we had been engaged on the western journey, Scott had made his depôt at One-Ton Camp, and had returned north to Ross Island, a fortnight before we arrived. During February the sea-ice had broken away far to the south of Glacier Tongue—which marked the water's edge in January—and it was now impossible to return to Cape Evans by the route they had marched south.

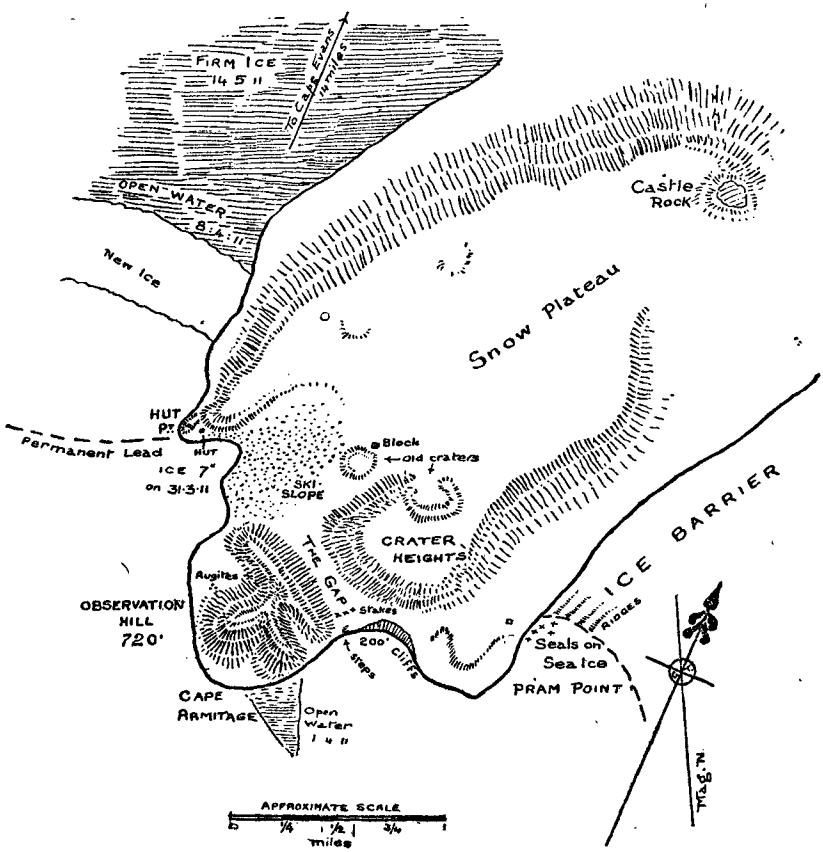
Moreover, the icy slopes of Erebus were seamed with crevasses, and many ice-falls lay at the root of Glacier Tongue, so that an overland journey was out of the question also. Luckily the old *Discovery* Hut had been placed on the long rocky southern promontory of Ross Island named Cape Armitage, and even under present conditions, with the water reaching to Pram Point, it was possible to get to this hut from the Barrier surface—as, indeed, the last chapter has shown.

A queer little hut indeed is this, compared with our palace on Cape Evans! It is square in plan, and rises to a central peak. All around is a sort of verandah, with outer walls reaching halfway to the ground. This was designed to hold stores and protect them from the blizzard snows. But the hut was hardly used at all by the 1902 expedition. When we first saw it in January, 1911, it was filled with snow and ice to within a few feet of the ceiling, and did not look by any means an attractive place of abode.

During February, Dr. Atkinson and Crean had spent a large portion of their time excavating the hut, and had ultimately cleared it completely of ice. A great heap of ice blocks and chips marked the extent of their labours. They had piled up the boxes of captain biscuits into a barrier enclosing the north portion of the hut, and in this dark retreat the western party found the depôt party on the 15th March.

We reached our refuge about 7 p.m. It was almost dark

outside and quite so inside. An acrid atmosphere of blubber, smoke, and soot enveloped us as we occupied the rough planks grouped around the heart of the hut. Here was built up a primitive blubber stove, crowned by a chimney whose vagaries formed the chief topic of conversation among the



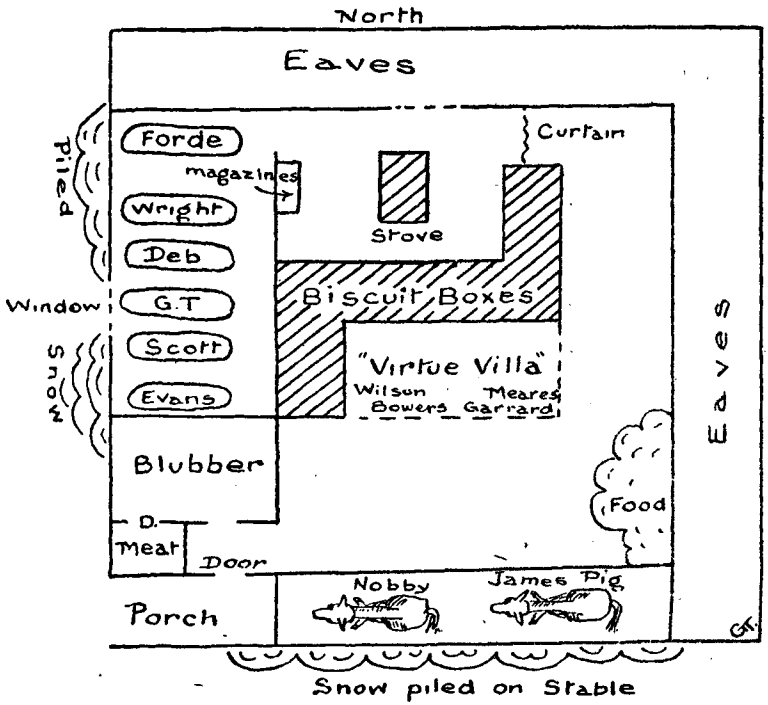
Sketch map of the Environs of Hut Point in March April 1911

inmates. Only one dim candle in a sooty lantern illumined the scene. The windows were deeply frosted, and it was getting on towards winter now, so that only in the middle of the day could they give much light.

As will be seen by the plan attached, our dining-room was

at the north, furthest from the blizzard winds. There were two bedchambers. One on the *west* side, where six of our sleeping-bags were disposed like sardines in a tin; and another *central* boudoir, rigged up out of antique canvas left in 1902. This the occupants called—as it seemed to us west-enders on a *lucus a non lucendo* principle—Virtue Villa!

In the semi-gloom of the hut it took me some days to find out my direction, for inside one seemed to be twisting



Plan of the rejuvenated *Discovery* Hut, March, 1911.

as if one were in a maze. In fact, to reach Teddy Evans' quarters one had to return practically to the door, having circumnavigated Virtue Villa.

That first evening we sat round the reeking stove and thankfully ate seal hoosh out of the tin mugs, helped down—though little it needed it—by unlimited captain's biscuit nearly ten years old. Captain Scott allotted the new-comers quarters in the west end, and we turned into our soaking bags and

slept fairly well in spite of the drips from the roof. Each sleeper unconsciously rolled away from the drops, and many were the territorial arguments caused by the drips from the ice-covered roof.

Next day at 6 a.m. the cooks (Meares and Keohane) turned out to prepare the breakfast. The others got up an hour later, to find a thick pemmican of seal-meat and curry awaiting their attack. Thereafter we each had a mug of cocoa. Work starts immediately, for we are literally living from hand to mouth. So Wilson and most of the men go off to Pram Point to kill our dinner. Teddy Evans with two mates puts in the morning cutting up seal-meat, while the western party set off to fetch in our second sledge from the slopes below Castle Rock.

From the top of the promontory by Castle Rock we got a good view northwards to Cape Evans, distance about twelve miles. There was open water this side of the Tongue, but ice was forming on it. Further north it looked more solid, and I lugubriously wrote, "It will be a fortnight before we get off, I fear."

The worst feature about Hut Point was the approach thereto. It was about twenty-five feet above the water-line, which here was bounded by an ice cliff twelve feet high at the foot of a quite steep icy slope. This slippery route fringed the bay, and was of necessity traversed by any one approaching from the north or east. As there was usually a blizzard blowing directly down this slope to the water, it took us some days to traverse "ski slope" with equanimity. We put rope grommets (brakes) on the sledge-runners, or the whole outfit would have sidled over the edge into the water. By 5 p.m. we had brought all our specimens and instruments safely to *Discovery* Hut.

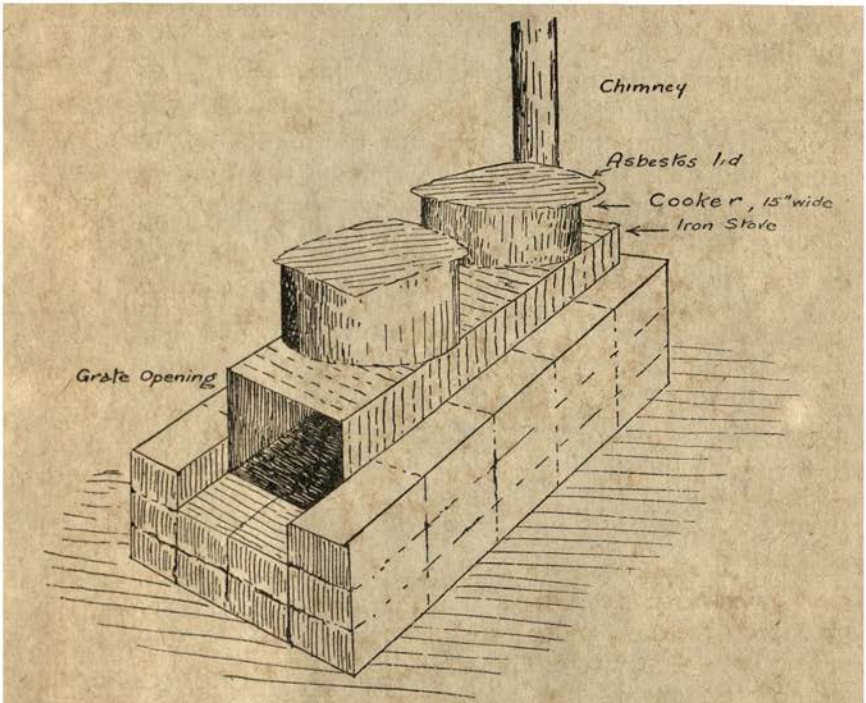
The other party had killed eleven seals, and returned two hours later. We had a grand feed of seal-liver seasoned with peas. A box of dried peas was one of the relics of the 1902 expedition, which was dug up from the snow; and though the outside was black and mouldy, the heart of the box furnished us with magnificent dishes of "pea-doo."

The blubber-stove worked better every day. One "fid" (or slab) of seal-blubber would soon make the iron top red-hot. So we were actually able to wash the pannikins! Only

those who have drunk cocoa and tea for months out of mugs, used also for pemmican and blubber fry, can understand the luxury of a *clean* drink.

Never shall I forget my feeling of comfort that night. We had managed to dry our bags in the midday sun, and I can still recall the springy warmth of the reindeer bags, after so many days of what at best was clammy discomfort.

On the 16th Evans led a party to Corner Camp, about



The blubber stove in the old *Discovery* hut, March, 1911.

thirty-five miles to the south, to get some fodder for our two ponies, and also some stores for the sixteen men in our little community. He asked Wright to join him, so that our mate was soon in the thick of the blizzards again.

Just outside the door were the dog-lines. The dogs lay in "rifle-pits" dug out of the icy slopes above the bay. Poor fellows, their fur was clogged with ice, and their short commons on the Barrier made them woefully thin. Very miserable did

they look for some days, for their hair is normally so thick that it lends them a fictitious size. I assisted Meares to dig the holes deeper, and build up barriers to the south. It was pleasant to see how the rest and abundance of seal-meat soon improved them out of all recognition. Many of them were loosed when we went for a walk. They would start out with us, and lend a touch of home to the dour landscape, but they were not very companionable, and, except for brown Tsigan, they always left us behind as too slow, and later bolted for the hut.

In a day or two our party swung into routine in the old hut. We could not move more than a mile or so from Hut Point. We had nothing here but fragments left over from 1902, and some sledging rations, and yet the time passed not unpleasantly, for there were a thousand and one jobs to be done. I will quote my diary fairly fully for 17th March, for it was typical of the next few weeks.

"We got up rather late, so that I read the thermometer at 9 a.m. instead of 8 a.m. After that had breakfast of porridge and a ripping 'hoosh' of liver. Then a cup of cocoa, to which three pills of Gran's saccharine gave a sweet inky taste. I next sewed up a six-inch tear in my sleeping-bag. I did not sleep well last night, nor did Scott, who was next; I will try fur *inside* to-night. It is blizzing again, and I am glad I am not on the Barrier with Evans, Wright, and the rest.

"Then I pared some seal-skin soles thin (the fresh skin is just like soft leather) and sewed them into the old finnesko presented to me by Gran. We played "shut-eye" for a tin of marmalade. [I ladled out a spoonful, and Scott, with shut eyes, said whose it was; and so on.] We had two and a half spoons each, and as it was Keohane's birthday I gave him the tin to scrape out.

"At lunch we had a great discussion on Browning and Tennyson. My simile comparing them to a rough rare mineral and polished rubbish was not accepted! Scott preferred Keats. Meares opened tins with my dagger in military fashion, as he had learnt in South Africa [*i.e.* he made a fulcrum of a bar of wood beneath the blade]. Scott tried to improve the lighting by smearing blubber on the windows, which at any rate made it easier to flake the fresh ice off each

day. Dr. Bill is mending gloves with pared seal-skin. Gran is making a ski-stick from a piece of bamboo he's found. Debenham is tidying the kitchen, and puts up racks to hold the 'spirtles' (*i.e.* porridge-stirrers). I rifled the 1902 magnetic huts, and cut out lids for the porridge-pans from sheets of asbestos. Our literature consists of *Contemporary Reviews*, *Eclectic Magazines*, *Girls' Own*, and the *Family Herald*."

We spent some time trying to make the hut snugger. We piled heaps of snow and ice against the walls to keep off the blizzards. Among the débris I found ancient dog biscuits which reverted to their original purpose, and an old bag of oatmeal which went into our menu. A great discovery was a torn copy of "My Lady Rotha." The first and last chapters were missing, but I gathered the loose pages and dried them, and enjoyed reading it again. Curiously no one else in the hut had read it, and as we had only about three books, every one read Weyman's novel. I couldn't remember quite how it ended, for the plot is very concentrated to the end; the elderly hero not having found a son or a second wife; and the lady debating between the ancient count and the lunatic lover. I am afraid I finished it off in several ways to various applicants, none of which would have pleased the author!

There was another book which Gran had taken sledging and had torn off the first few pages for pipe lights. This was "Springtime," a romance of medieval Italy. A good yarn, and Scott guessed it was by Hewlett. I disagreed, but couldn't remember the writer—who is H. C. Bailey, I believe.

It was very curious how useful were the 1902 remains. That expedition wintered on the ship, but some articles had been left ashore, and the hut had only been used as a hospital.

However, we found old *awnings*, which Taff Evans used as arras (or is it *arrases?*) for our bed-chamber! There were asbestos sheets with which we levelled the floor, and made pan lids; brass nails, also from the magnetic hut, which had not rusted of course; long stove pipes and asbestos cement, with which we ultimately made a smoke-free blubber stove. A dubious mass of brownish glue turned up under some snow. Bowers tested this, and ultimately we had bovril

flavouring in all our hooshes! And there was of course the definite depôt of captain's biscuits left in 1903, and also a few wholemeal biscuits which Shackleton had depôted in 1908. The latter swelled like muffins on the red-hot stove, and we used to have one with butter as a special luxury. Those Shackleton biscuits were a dream!

On the 20th seals were reported just under Hut Point, and of course were much handier than the rookery at Pram Point. So Scott and four of us went off to get them. We lowered Keohane and Evans down the steep cliff below Vince's Cross on to a piece of fixed floe, and the two seals were killed with a few blows on the nose with a pick handle. Dr. Bill and Meares went down to help cut them up, and Scott and I hoisted the flesh up by the ropes. Just as we were finishing three more seals appeared, and one crawled right up to the shambles. He stayed there all the time, and only left when the carcases were thrown overboard.

That night there was a wild storm. Spray was blown up over the cape and over the hut, where it instantly froze. It cemented the snow heaps, and would have encased some of the dogs if they had not been freed from their chains. Next morning I had to chip my way down to the shelf where I had left the thermometers. We had to cut out fresh holes for the dogs, during which operation one aggressive fellow got hold of another by the neck, and the combined efforts of the sapping party could not drag him off.

When the weather permitted we went off to get seals or to have some exercise. A strong wind used to blow almost constantly towards the hut through the "Gap."

Often when one was loaded with seal blubber, or camping material, the icy slope between the gap and the hut was dangerous work. By this time our crampons (spiked overshoes) were useless, for the spikes had worn quite blunt. The wind would catch us, and irresistibly slant us down the ice slope to the sea. On several occasions, when one of the Western Party was wearing his iron *steig-eisen*, an unfortunate crampon-wearer would clutch hold of him and accept escort over this giant "slide."

What long discussions we had! Scott was interested in everything, and I note that one evening we discussed

Photo by H. G. Ponting.]

CRATER HEIGHTS, THE GAP AND OBSERVATION HILL AS VIEWED FROM THE OLD "DISCOVERY" HUT.

The catenary curve of the Gap, due to glaciation, is well shown. In the foreground is the icy slope which ended (abruptly on the right) in open water.

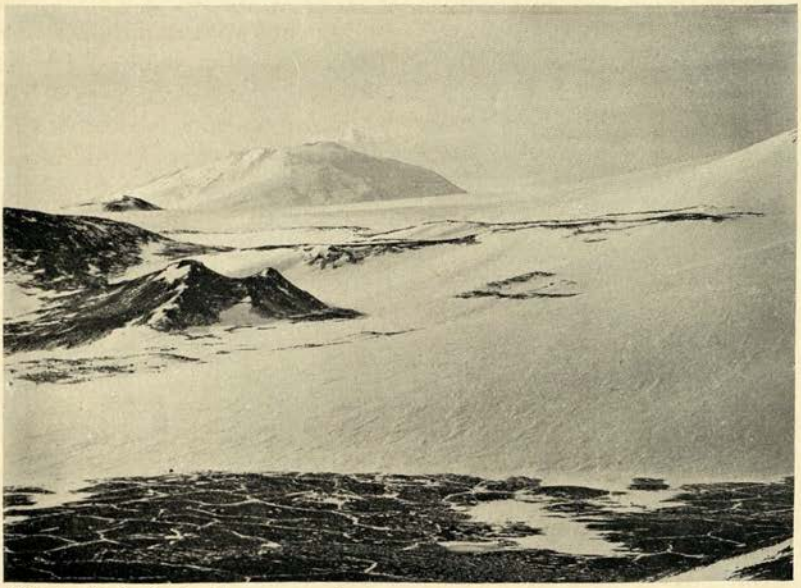


Photo by H. G. Ponting.]

MOUNT EREBUS FROM THE OLD "DISCOVERY" HUT.

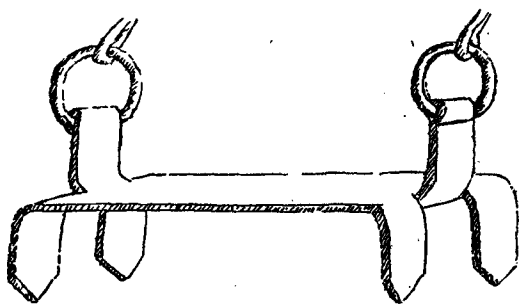
The steam cloud is blowing to the south-east against the prevailing surface winds. The small craters of Cape Armitage are shown on the left as stumps of lava. A series of false moraines crosses the picture (due to rock fall). In the foreground are the "tesselations" due to soil-creep.

Mormonism, the medieval ramparts of Aigues-Mortes, and the pronunciation of ancient Greek!

On the 23rd March the Barrier party returned. They had experienced temperatures of −42° F. Wright told me that it used to take three hours to get warm—after they had thawed the ice out of their bags. On leaving the tent in the morning in a clammy wet state, the instantaneous freezing of their clothes felt like an electric shock!

I made a tour to inspect the "moraines" on Crater Heights, accompanied by Dr. Wilson. I believe they are due to differential erosion of lavas of varying resistance, and have not been left there by an upward extension of the Barrier Ice Sheet.

Dr. Bill told me of the loss of the ponies. He and



Steig-eisen 11·2·11

Meares with the dog teams made straight across to the hut over the sea ice from the Barrier camp. They noticed cracks every thirty feet or so, and so deviated sharply to the east, and reached *terra firma* at Pram Point. They then started cutting a track up the ice slope for the ponies. Meanwhile Bowers, Garrard, and Crean had not noticed the dog teams swerving, but had turned back later. They had to camp on the sea ice, because the ponies were too "done" to get back two miles to the Barrier ice. They woke in the small hours of 1st March to find that one pony had vanished, and they were adrift on a broken floe. They drifted about all night and next day, while Wilson could do nothing but watch them from the top of Observation Hill. Wilson went off and met Scott, who had come to the open water, and was able to tell him that there was a chance yet.

The pony party spent four hours or more trying to get to a large piece of ice to the south, which seemed to be separated from the firm barrier by a narrow crevasse. They left the ponies and went off to prospect, and found the space was sixty feet wide and full of grinding floes! There was a big swell all around, but Bowers gave Crean permission to try to cross the gap. He managed to do so by some amazing jumps, and with the aid of two ice axes he climbed the edge of the Ice Barrier, and so informed Scott of their danger.

Meanwhile Cherry and Birdie took things philosophically. I heard how Birdie took angles with the theodolite to determine the position of their floating island. A skua gull settled near them, and Cherry thought it well to annex this food supply, and did so. I was told that Crean made some stiff cocoa for them while they were trying to rescue the sledges. In the dark he mixed the food bags and a strong decoction of curry resulted. Nothing daunted, the Irish sailor declared it was as warming as the other, and drank it off.

On the afternoon of the 1st the rescue party managed to communicate with them, and Bowers and Cherry and most of the sledge stores were saved. But the ponies had to be left that night with feed bags to comfort them. Next day the three ponies had drifted to a more favourable spot farther to the south-west. Here the rescue party busily set to work and cut out a path up the face of the Barrier. Nobby was jumped from floe to floe, and at length reached the firm ice of the Barrier. But the other two ponies were weaker. The second jumped short, and though he managed to scramble on to the floe again, he was too cold and weak to stand, and fell into the water again. So, too, the third pony. All round were eighteen killer whales waiting for the end. To save them from a worse death their owners polé-axed them as they feebly struggled in the icy waters of the Sound.

[The tracks on the breaking edge of the Barrier were seen by us on the 11th March, just before the blizzard caught us and held us up two days.]

There were now again sixteen men in the old hut, and sleeping quarters were arranged as follows. Scott, Evans, Taylor, Debenham, Wright, and Forde slept in the West End; Wilson, Meares, Bowers, and Garrard in Virtue Villa;

BOWERS' PARTY ADRIFT ON THE SEA-ICE.

From a drawing by D. Low.

while Gran, Taff Evans, Keohane, and Crean lay around the stove.

With so many human furnaces at work, the temperature inside the hut rose to 46° F. on one occasion. As a natural result, our ceiling dripped abominably. We laid hands on all the empty tins about, and tied them on strings to the ceiling under the more obnoxious drops! Very skilfully we each tried to lie between two small cataracts, with the result that boundary commissions were frequently necessary to decide on encroachment into foreign territory!

The activities of the geologists incited all the other officers to emulation. Bowers was the most indefatigable of these "pseudo-scientists," and was always bringing some huge specimen along to Debenham or myself. "Here you are," Birdie would say of a particularly uninteresting block, "here's a gabbroid nodule impaled in basalt with felspar and olivine rampant."

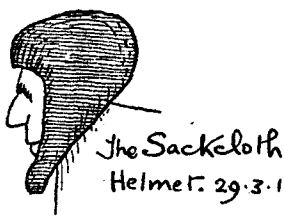
The sun was giving us his farewell before winter. Very beautiful were the sunset tints; and on the 25th I wrote: "Over Mt. Discovery are bands of stratus, across a black sky, while in the foreground are pools in thin ice looking like bog lands. To the south the sky shows orange-yellow to white tints; to the north, beautiful lemon-green verging into grey and yellow on the east. To the west, grey-green, with a bright orange band against which stands the purple line of Mount Lister. D—— fine, only I'd rather have two feet of solid sea-ice, and no lemon-green reflections in the pools!"

Later in the day, Wilson gave Oates and myself a talk on tone-values. At 6 p.m. the landscape was rosy pink everywhere where the sun glanced on the snow-fields, salmon to buff colour on the open water, and on the newly freezing sea iridescent like tar. The shadow of Brown Island was lemon-green, changing to purple on Mount Discovery—while for a few minutes our own shadows were the most vivid bright blue!

It is impossible to imagine how striking if evanescent these colours were, and as possibly some critics believe that Wilson's sketches erred on the bright side, I have here copied my notes made on the spot, while Dr. Bill was drawing his sketches.

Next morning I was cook with Wright and Titus Oates. I lit the blubber lamp and a candle while Oates set the fire going. Some chips and a page or two of the *Quiver* rubbed in blubber started it that morning. It was then only necessary to put on a fid of fresh blubber from the tin alongside, about the size of a bath bun. The blubber sizzled merrily on the grid, a big hot flame sprang up and licked the blubber and melted fresh supplies, and soon the stove was going strong. The hoosh was a porridge-biscuit dish with a few bits of seal in for luck. After breakfast I washed up the pots and cleaned the cookers.

Captain Oates apparently had a Spartan objection to our comfortable clothing. I shall have something to say about his canvas trousers, but his objection to our helmets resulted in a Dutch sackcloth affair which was designed and made in the old Discovery Hut.



About this time Debenham was discovered to be an expert cook, and thenceforward presided over the culinary mysteries. His speciality was a confection known as "chupatties." These were a kind of unleavened currant scone, made of flour and biscuit-dust and some corn-flour. We used to have about four to a man, so that sixty-four of these took some making.

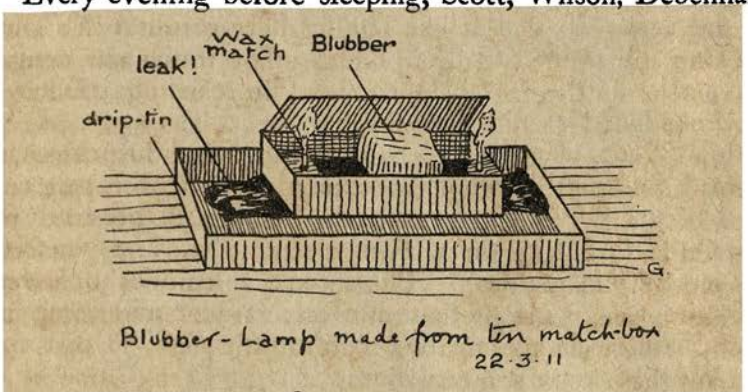
Some of our fireside arguments were quite lengthy. I raised the question of city design, advocating the cobweb pattern. I found that Wilson agreed with me, while Scott and Wright took the opposite view. Belfast and American cities, Paris, Melbourne, London, and even unborn Canberra (the Australian capital) were dragged into the debate. After it was well started we drew back and enjoyed the "cag" between Dr. Bill and the Owner, each backing his own views with great pertinacity! On another evening we had the oft-arising problem as to whether Lord Kelvin was a Thompson or a Thomson, and I won a stick of chocolate through chancing on the right spelling.

Towards the end of March the ice in the bay by the hut commenced to freeze. On the 28th Wright was lowered on to the Bay and found the ice three to four inches thick, so

that we began to have hopes of getting to our own headquarters in a week. Dr. Bill and Birdie made a remarkable feast which they called seal-rissole. We indulged largely and —probably in consequence—vivid dreams were retailed next morning.

There is nothing so boring as dreams, I am aware, but I am going to quote my diary! "I was back in a suburb of Sydney, and in the distance saw an acquaintance of mine (H——). He moved away hurriedly. I caught him up, and told him I was really in Antarctica, but wanted him to note the time when I astrally visited Sydney. I remembered his name was Rupert. Guess this was the effect of the rissoles."

Every evening before sleeping, Scott, Wilson, Debenham,



Blubber-Lamp made from tin match-box
22·3·11

and I had some sort of a scientific discussion, usually on a local geological problem—such as the origin of Castle Rock—for many such confronted us.

For these evening occupations we used home-made blubber lamps. A favourite make was based on a tin matchbox. Two ordinary wax matches served as wicks. As usual with blubber, the black oil leaked everywhere.

On the 31st Wright and I found that Discovery Harbour had 7½ inches of ice over its surface. The ice looked just like cocoanut ice and was no harder, but was very elastic and supported us safely. We walked across to Observation Hill, and saw a seal near the shore. I wrote, "Charles smiled at him, and as he fainted I poleaxed him. He wriggled twice or so and then died." We climbed up and over the Gap, and got down on the east side. Then we walked two miles to Pram

Point. Here the ice varied somewhat. In places huge splashes of slush had frozen; in others ribbons eight inches thick had overridden each other. All seemed bumped up by swinging against the fixed ice-foot. Black wedges of clear ice grew out into the water channels, and the edges of the latter were often warped and twisted. In Pram Bay there were numerous seals; one barked or growled, another opened his jaws nearly 180°, and his tongue shivered at us. A third gurgled musically, but only on one note. Later I saw one menacing his neighbour and barking at him.

About 200 yards inland was a cache where we had seven seal carcases ready for consumption.

As we returned I found some small fish, about eight inches long (*Notothenia*), buried in the ice, and three smaller fry lying on the surface. The stakes left by Ferrar in the ice across the Gap still seemed to be in line, so that there had been no movement of the ice since 1903. On reaching the hut we reprimanded Dr. Bill and Bowers for collecting "gabbroid nodules," etc., when their zoological tastes should have sent them fishing. After which we exhibited the frozen sprats.

I began the month of April by helping Bowers as cook. I write: "At 7.15 threw back sleeping-bag after uncoiling my jersey from my neck. Put on coat and finnesko, and was fully dressed. Curious that one feels no worse for lack of a wash, bath or change, for over two months."

We had a tasty bovril hoosh, flavoured by some of the treasure trove. Debenham and Wright dived deeply into their pots and brought up chaff. (Birdie's joke for April 1st!) The seal we had killed was declared to be suffering from liver complaint, and weak heart. Hence his susceptibility to sudden shock! Anyhow the dogs ate all but the flippers and seemed none the worse.

Wright and I went further south on our next walk, right beyond Cape Armitage. I took to finnesko finally, for conduction along a big nail in the leather boots had frost-bitten my toe, and for months afterwards I had little sensation in it.

"We saw an emperor penguin walking towards us with a rolling gait. He retreated as we individually surrounded him, then bolted on his belly with snaky neck vibrating amid squawks. He turned on Wright, who killed him with two whacks on the neck and two picks in the brain. I pithed him

with my penknife. Unfortunately he bled muchly and spoiled his yellow tie, so we dug a little pit and laid his head therein, to save the plumage."

Off the end of the Cape were many open pools of water, but I crossed between easily enough. The water was washing across, and had perhaps thickened the band of ice. Here I found many of the fish on the ice surface. Probably they were chased into the mushy ice by seals, and froze fast. I proceeded round to the east, and then climbed Observation Hill, finding Dr. Bill on the top busily sketching.

"As the sun sank below the stratus cloud the golden beams shone past the Hut and showed up beautifully on the snowy surface of the Sound. We saw this tawny area gradually advance to the fixed ice and give it a rose-pink flush. The deep purplish shadow from Hut Point enchanted Dr. Bill, who made a complete sketch in about ten minutes. The sun's low shadows on the slight corrugations of the ice and the elongated shadows of Wright with the sledge were very striking.

Later Scott returned and complimented us on getting round the Cape safely; in fact, he said that he was glad there were pioneers ahead when he tackled it!

On the 2nd Scott reported the first aurora at 3 a.m. He said it extended to within ten degrees of the zenith from the south, was of a reddish hue and like a curtain with two folds. Birdie saw it later and said he thought it was a peculiar cirrus cloud! So I felt that the colours could not have been very brilliant.

Scott, Oates, and myself never aspired to be considered cooks, but it was pleasing to see the anxiety of the others to earn a *cordon bleu!* But I was quite willing to help if others shouldered the ensuing blame! For instance, at lunch on this particular day Wright and I made what he christened a "cheese sponge." "We stirred it about an hour in hopes of getting it to 'jell,' but it remained obdurately granular. However, by carving off lumps of our butter it went down O.K. But a quarter of a pound of butter for sixteen men is little enough!"

Lieutenant Evans started to cut a road down to the bay ice through the twelve-foot ice cliff. We dumped the ice from the excavation on to the bay ice, hoping to build up a

ramp. The ice was in layers alternating with snow, the former probably representing spray-cemented snow. Soon the sea ice cracked under the weight of our delta, and the latter sank more and more. It was like filling the ocean, and at 7 p.m. only a few jagged blocks showed where we had piled all our excavated material.

We had some of our penguin for supper. He weighed 92 lbs., and was about a record.

The "pseudo-scientists" were keen collectors. Some augite crystals being found on the side of Observation Hill—we geologists did not strain our consciences much by assuring them that they were gems! As a matter of fact, I once wore an augite as a stud; but it would only appeal to a geologist. However, Birdie and Cherry spent several hours crawling up the slopes of the hill. The augites took much finding, for they were rarely half an inch long. "Dry-blowing" and scraping in the snow and ashy rock with frozen fingers and colder toes was the method of work. Some of the specimens picked out of a red tuff showed very pretty crystal faces. But the mineral is nearly black and rather brittle, so that their value is purely scientific.

One morning we were promised a new dish of "whales on toast" by the indefatigable chefs. These were biscuits fried in butter and crowned with two sardines. Unfortunately they all got burnt, and the many requests for biscuits *au naturel* disconcerted Birdie! In the evening Evans and Wright laboured long at a dish which they finally labelled "glue" in disgust, though they had hoped it would turn out a stew. So Meares enlivened the gloom by a yarn. "A man went into a shop in our town and took off an article on approval. Unfortunately he left no name. The assistant said, 'Whom shall we charge it to?' The proprietor said, 'Put it down on every one's bill, and we'll soon find out who didn't take it.'" Meares stopped, and we asked, "Well, how did it work?" "Oh, the last I heard, forty of them had paid for it!"

On the 7th, Scott asked if any one wanted a walk round the sea ice to Castle Rock. Atkinson and I volunteered, and we got on our crampons and *steig-eisen*, and I took an ice-axe. We went down to the sea-ice over the ice cliff, using the old hawser left there in 1903. The ice was about four and a half

inches thick, and Scott tested its bearing strength by the simple method of jumping on it hard. It bent considerably, and water gurgled up through the holes, but this new ice is fairly tough.

The surface was mottled, due to its being largely composed of cemented pancake ice. The ice was mushy, and overriding was very common. Occasional retreats and breaks led to leads of open water. Scott pointed out to us where Vince was lost in 1903 on the icy slopes to the south of Castle Rock. We discussed what a man should do if he fell into

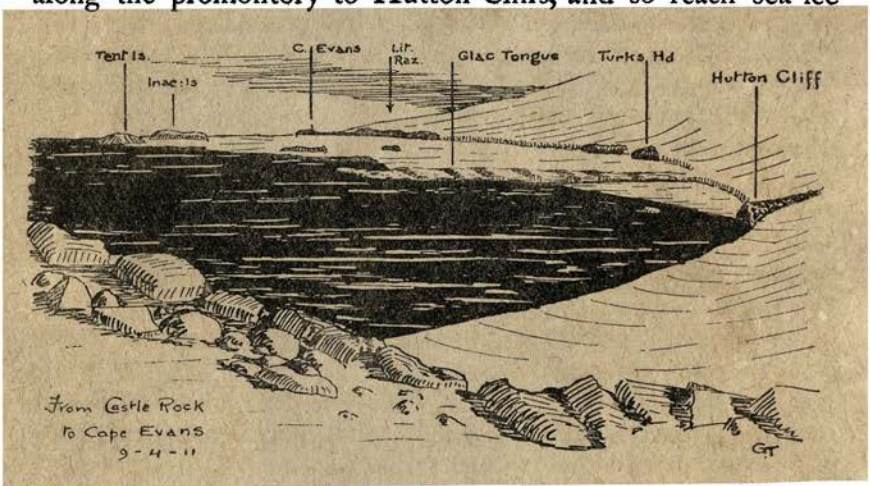
Testing the sea ice off Castle Rock, April 7, 1911. Atkinson, Scott, and Taylor.

the sea and was rescued, and Scott said the only thing was to keep on the move.

We crossed several "leads" of black ice, which I tested first with the ice-axe. "I chipped at the next and saw that the ice was more than an inch thick, so I boldly ambled across. I made a long step and one leg gaily went through and the other followed, but I hung by my arms fairly comfortably. Luckily I had an ice-axe. Atkinson stretched out his ski-stick, but I drove the pick in and pulled over to the further firm ice and managed to slide out, while Scott was getting over further to the north. The water was not cold, and I didn't feel excited at all. I went in up to the

armpits and was dripping, but only my toes were cold. Scott said he was just going to tell me not to try there; and I told him the practical experience should balance the foolishness!" Cherry returned with me to the Hut about two miles south. Luckily there was no wind, or twenty-four degrees of frost would have been serious. My note-book was well inside my wind clothes, and the chronometer was not hurt at all.

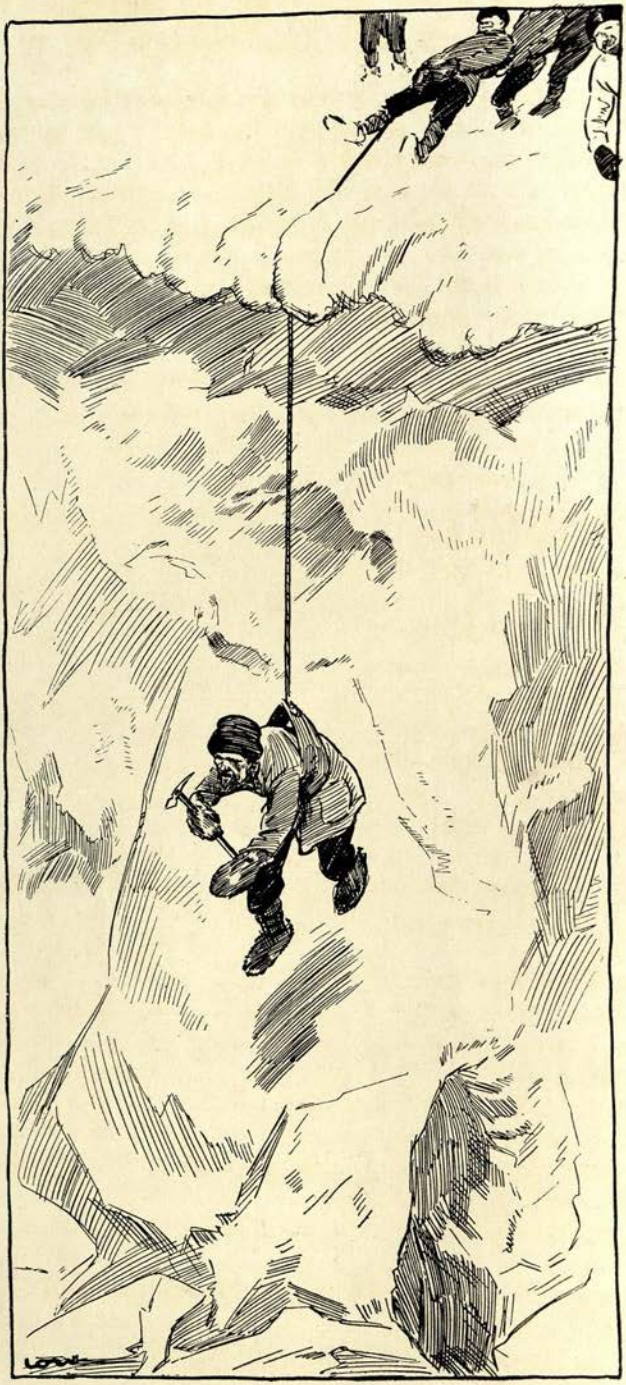
That evening there was a strong blizzard, and every vestige of ice blew out to the Ross Sea. It was lucky that the wind did not spring up six hours later, for Scott had decided to start off this very morning for Cape Evans *viâ* the sea ice. As a result he determined to try a land route along the promontory to Hutton Cliffs, and so reach sea-ice



where it was more land-locked and protected by Glacier Tongue.

Gran and I went off to Castle Rock to see what the ice looked like in the bays to the north. We arrived at the base of this 200-feet crag about 1 p.m., and decided to climb it. Gran was wearing boots and so could get a grip, but I had on fur finnesko and found it a tough job. In fact, Gran had to spread-eagle himself on the face of the cliff, and I got up by climbing up him, like a human ladder.

This old landmark is 1340 feet high, and is built up of volcanic agglomerate. There is an almost sheer drop of 1200 feet on the west; but the top is nearly flat and offers a fine view. I could see a little patch of sea-ice in the bay



OVER THE HUTTON CLIFFS TO TEST THE SEA-ICE.

From a drawing by D. Low.

near Hutton Cliffs, but north of Glacier Tongue the sun was in our eyes and we could not see if ice or water lay between the Tongue and Cape Evans.

On the 11th of April nine of us started for our own headquarters, leaving Wilson in charge of a party to bring over the dogs and two ponies. [The track is shown on the map, p. 88.]

"The 'relics' helped us up the two snow slopes. Birdie and Bill arranged signals with fireballs at 10 p.m. on the first clear night in the next three. Dr. Bill had an understanding with Scott that he should not move with the ponies and dogs until the sea-ice had stood a blizzard. We passed Castle Rock and were going strong at noon. I had been leading, giving Scott my shoulder, but here he shortened my rope and I pulled just behind him. Beyond Castle Rock all the land is untraversed. We kept for one mile along a steep snow slope, seeing no crevasses, and easily reached the flat top of the promontory. After about four miles we approached Hutton Cliffs and could see patches of blue ice on the slopes ahead. Soon we met some crevasses, and both of us fell into small ones. We got to a ridge of boulders which showed where we were to get down to the bay ice, if anywhere.

"Quite suddenly it began to drift heavily from the south, and we had to put up the tents and camp. We had some tea and then prospected for a route to the cliff edge. There were huge crevasses zigzagging across the blue ice below us, but when the drift stopped we found a good track and soon reached the cliff edge. Here it was thirty feet high with snow whirling over on to the bay ice. Further south it was a little lower, and here Scott lowered me on to some fallen blocks on the sea-ice. Then Evans, Wright, and Bowers followed, and we guided the sledge down, fully loaded, without difficulty. Two bamboos were stuck in and the rope passed round. Crean arranged this, and Scott came last, being lowered from below.

"We left the Hutton Cliffs about 5 p.m. and pulled north over two miles of soft sea-ice to Glacier Tongue. We anticipated trouble climbing the Tongue, but found a spot where its edge was only ten feet high. Evans and I were lifted up, and in ten minutes both sledges and men were on

the Tongue. It was good fun crossing the Tongue, for there were numerous crevasses to jump, none of which was particularly risky, though Evans fell into one. We camped on the north side about 6.45. It was pretty dark, but after some tea Scott decided to push on for the remaining five miles.

"We had to steer across the bay ice by observing a star, for it began to grow thick near the surface. I tested the ice with my axe fairly frequently. We pulled all we knew, for occasionally our only beacon (the star) was almost obscured. About 10 p.m. a black patch showed up, which we guessed must be Little Razorback Island. Here Scott decided to

The two tents on the ice-shelf at Little Razorback Isle, April 12, 1911 (looking south).

camp. We had a difficult job gathering mushy-ice to weigh the tent-flaps, but all turned in on the wet ice before midnight."

I don't think many of us enjoyed the situation. We were camped on new ice and had not the faintest idea how far off the open water lay, and we had practically no food with us. Next morning, before it was properly light, a blizzard came up to add to our discomfort. We could not see Cape Evans or tell whether there was ice or sea in the intervening two miles.

I climbed up the Razorback, cutting steps up the soft ashy rock with my bowie knife. Bowers and I explored an ice-ledge on the south side of this little islet. On reporting to

Scott he inspected it, and in the afternoon we shifted camp up on to the ledge, whence we could not drift out to sea if the blizzard increased.

"I snoozed about an hour during the night, pulled the flaps of my bag tight, and apart from frozen toes—partly owing to my home-made sealskin finnesko being too tight—and shivers in the back, and the soppy nature of all my clothing, I was pretty comfortable!

"We roused at 7 a.m., and I had to wait half an hour before my fur mits thawed out enough to be wearable. We finished up our pemmican and biscuits. Birdie was cook, and as usual took too little for himself, and made a fuss about filling up his own pot.

"We packed up at 8.15, and found that the wind helped us materially. The ice seemed firmer here, and near Inaccessible Island we crossed tracks and a silk line, evidently due to Simpson's balloon experiments. We rounded Cape Evans and saw the open water less than a mile off, so that we were pretty close to it at Razorback.

"Another hundred yards and we saw the hut with two men moving about. We went on silently (by order), and saw Lashley stand up, look our way and stand rigid. Then he spoke to Anton (who phlegmatically took no notice) and bolted into the hut. Soon they came streaming out in all sorts of overcoats, etc., Demetri and Lashley leading, Day next, Ponting, Anton, Simpson, and Hooper!"

Nelson was asleep, and Clissold too interested in some cooking!

We learnt that all had gone well except that one pony (Hackenschmidt) had died of inanition and a bullet!

We pulled on, and Birdie fell into the broad tide crack. I got across safely with the ice-axe and so to the hut.

I noticed the fine door-knobs, and the wooden number on our front door. The kitchen looked O.K. with bright tins and acetylene lighting, and all else was much about the same.

1

Postscript (that evening).

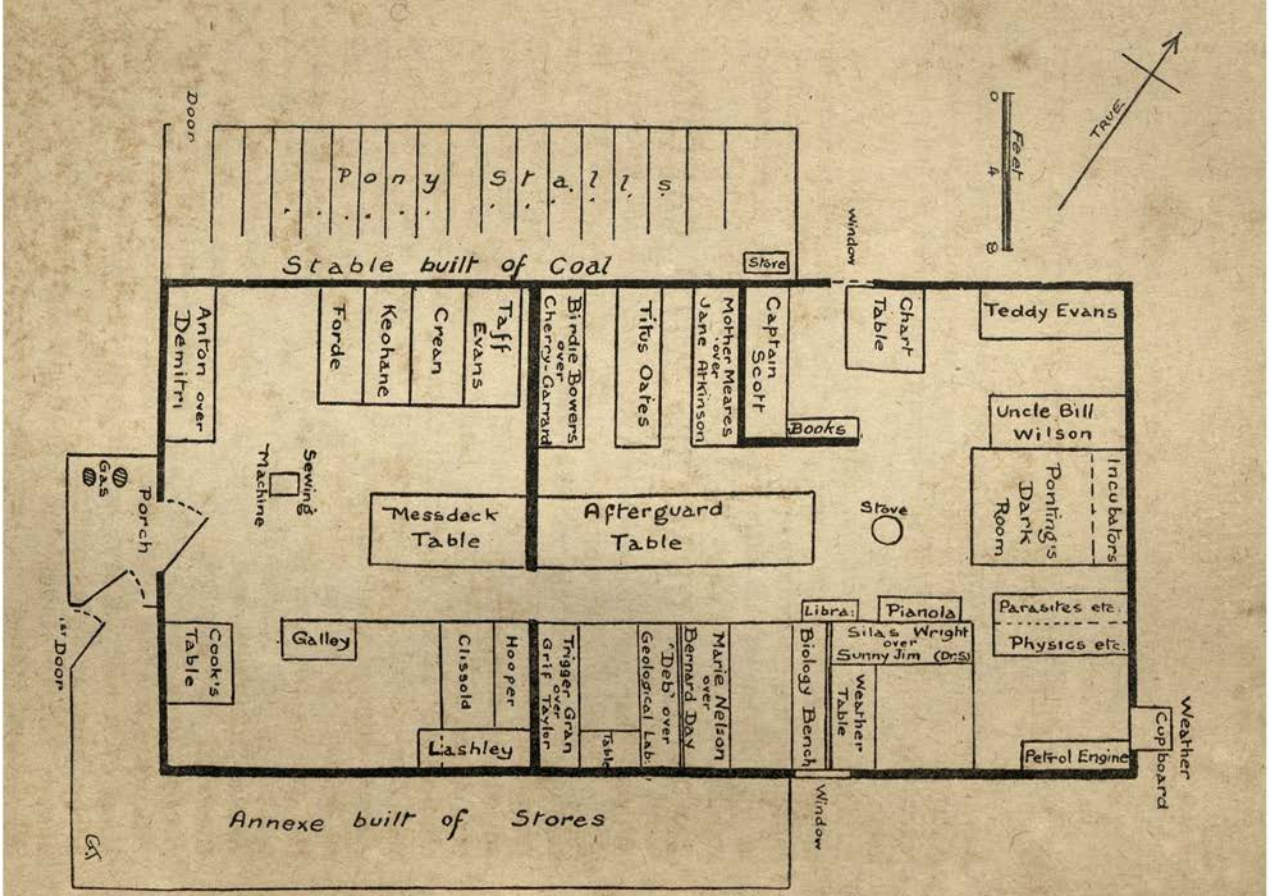
"Here am I in the hut, using my fountain-pen again after twelve weeks without refilling—only it's made a blob!

It is midnight and I lie in my bunk. 'Marie' Nelson is taking meteorological readings, and remarks that the Skua Gull (*i.e.* G.T.) has resumed his predatory habits. The others are sleeping except Ponting, from whom I got my candle. But everything feels too warm and clean for sleep! Clocks are ticking everywhere!"

V

IN WINTER QUARTERS WITH CAPTAIN SCOTT

APRIL—NOVEMBER, 1911



Plan of hut, 1911, showing nicknames and bunks of Explorers.

IN WINTER QUARTERS WITH CAPTAIN SCOTT

AFTER our return from the summer's sledging a new phase of Antarctic life began. For the next seven months we were practically confined to Cape Evans, and often to the hut itself.

During our "habitation enforced" it was rare for any man to be addressed by the name inherited from his parents or chosen by his godfathers and godmothers! The nicknames of the fifteen of the afterguard had by this time become standardized, and I think merit a little attention.

Captain Scott was invariably known as *The Owner*, a naval term always applied to the captain of a warship. Dr. Wilson (baptized Edward Adrian) was always known as *Bill*. *Doctor Bill* at first, *Uncle Bill* later, as one grew to rely on him more and more. Lieutenant Evans had four pre-initials, but was always called *Teddy*, which eminently suited his cheery frame of mind. Dr. Simpson was early caricatured as *Sunny Jim* by Lillie, and soon every one, including our leader, called him nothing else. Captain Oates was *Titus* to all of us, except to Bowers, who called him *Farmer Hayseed*, while Captain Scott usually referred to him as *Soldier*. Ponting was *Ponko*, and his chief aim in life (to get us to pose for him in all sorts of uncomfortable places) is perpetuated in the verb "to pont." Nelson was *Bronte* naturally, and more obscurely *Marie* from some theatrical star met with in his varied career. Bowers was *Birdie*, from his outstanding features and Titian crest. Atkinson was shortened to *Atch*, or at times *Jane*. We were short of female society—which lack also accounts for *Jessie* Debenham as an alternative to *Deb*. Cherry-Garrard was always *Cherry*—though an affectionate variation was *Cheery Blackguard*, while the seamen—baulking at the hyphen—called him Mr. Gerard! Our Canadian Imperialist, Charles

Wright, bore with equanimity the name of *Cousin Silas*, though perhaps *Carolus* and *Tranter* (*Toronto*) were more to his taste. *Bernardo* Day and *Trigger* (Tryggve) Gran were less remarkable ekenames. I gave up counting my own. *McCormick* (Skua—alluding to the rapid disappearance of some apricots), *Keir-Hardy*, *Sharn-Gatch*, and *Old Griff* were but a few.

Before we had time to change into semi-civilized garb the indefatigable Ponting had us outside to "pont" for him. Luckily there were no melting icicles available, and he was content to get us standing near the sledges. Some of the others had already shaved off their beards, much to Ponting's disgust; but mine was so rudely criticised that I kept it most of the winter to show *my* opinion of it! I assisted Ponting to the best of my ability by adding a touch of verisimilitude to Debenham's photograph, and threw some snow at him at the critical moment; but most of us looked such pirates, that there was no need for any further touch of Antarctica about us.

I spent the day sorting gear, ". . . and about 1 p.m. I had a gorgeous bath—the first for three months. Funny thing, no effect from no wash, no change, no hair brush, etc."

I suppose the cold accounts for no ill consequences, but I have ever since felt more sympathy for the Southern European peasants, for their ablutions are equally simple; they also do without a lot of impedimenta, and are equally healthy!

Ponting took his plates off to the dark-room, and submitted proofs next day! "Debenham says he looks just like an aboriginal—and far be it from me to contradict him." Captain Scott and Seaman Evans seemed to develop an Irish appearance, while I scorn to repeat the comments on my portrait.

On Sunday afternoon I had a stroll with Nelson, who told me how the nine at the hut had spent the time. Dr. Simpson was in charge, and had converted the newly built hut into a palace of mystery. In his corner to the south-east a small Gardiner oil engine was clacking away. This was used primarily, in conjunction with a dynamo, to charge accumulators for his electrical recording instruments. Mysterious clicks and gasps and ticking galore warned us that chronographs and other wild fowl, to be described later, were brooding

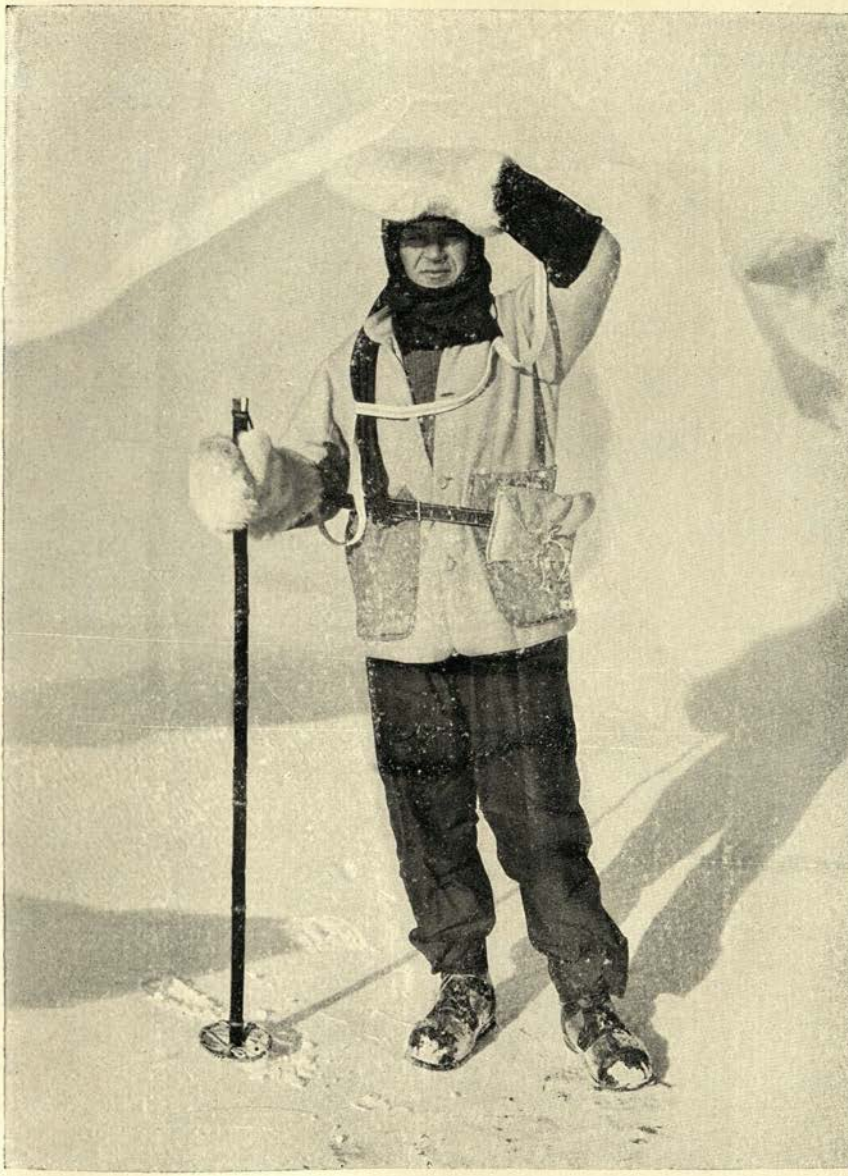


Photo by H. G. Ponting.

CAPTAIN SCOTT WEARING THE WALLET IN WHICH HE CARRIED HIS SLEDGING JOURNALS.

over meteorology yet *in ovo*. Ponting had "raked in every little bit" available, including some magnificent studies of surf breaking on the ice-foot. Day and Nelson roused our envious admiration chiefly by the condition of their common cubicle. No old beams from the stable framed their bunks! They were supported by carved and polished standards, encased in veneer (of venesta casing); and below were some fine specimens of joinery in the shape of two capacious drawers!

Day had equipped the hut with acetylene. The generator occupied a corner of the enclosed porch, where one could hear it gurgling as one entered the hut. If the outer door were not shut properly the fact was made evident by the dimming of the light! For the water in the generator soon froze if a blast of —40° struck it from the outer darkness. We were prohibited from carrying candles through the porch into the verandah storeroom for fear of explosion.

Nelson and I initiated the survey of Cape Evans on that stroll. The lakes had diminished greatly; not by ordinary evaporation, but through the removal of ice particles by the process of ablation. The margin of the lake ice was fringed by "blobs" of ice united into a lacework, and day by day one could see this fringe vanishing. It was curious that the small animalcule (*Flagellata*, etc.) should in some cases belong to the same genera as in English ponds!

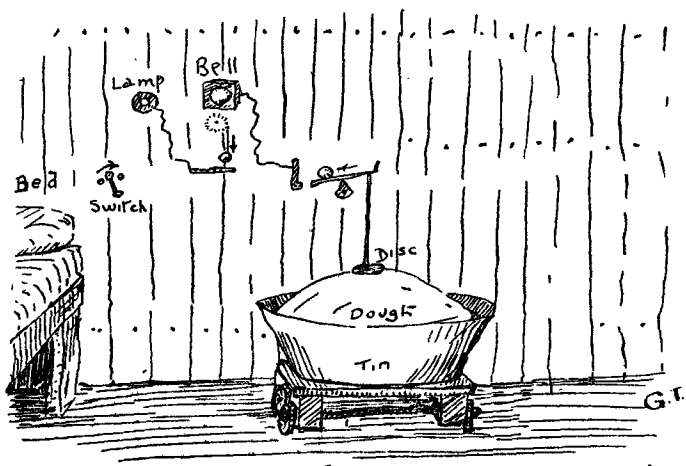
Cape Evans is a low promontory of triangular shape. Its average height is only about twenty-five feet above the sea, though Windvane Hill rises to sixty-five feet. The south-western portion consists of rocky ridges of kenyte with steep cliffs adjoining the sea, but to the north-east is a gravelly plain surrounding Skua Lake. Quite abruptly on the east and about half a mile from the western extremity, rises a steep bank of gravel (the Ramp) to a height of 150 feet. A few hundred yards of slope studded with quaint cones of rubble brought one to the edge of the great sheet of glacier ice which covers the whole western side of Mount Erebus. This was our domain, and to this cape we were practically confined during the ensuing six months (see Map No. 4).

Patches of ice covered portions of the cape, but the rest of the surface consisted for the most part of kenyte gravel with ridges and bosses of solid lava (kenyte) projecting through it, especially to the south-west. These dark lavas undoubtedly

represented an earlier offshoot from the volcano of Erebus, probably a subterranean flow; while careful mapping later on showed us that the little sheets of ice were not haphazard, but were "glacierets" fed by blizzard snowdrifts.

The most ingenious apparatus in the hut was due to Clissold the cook. This was an electrical device to tell him when the "bread was riz." He used to make the dough in the galley and place it in a big pot, puncheon, or pan. This was supported on a little trolley and stood at his bedside. The dough mixed, Clissold turned into bed, and left the rest to the yeast cells.

When the dough rose sufficiently it pushed up a disc



The Electrical Breadmaker!
17.4.11

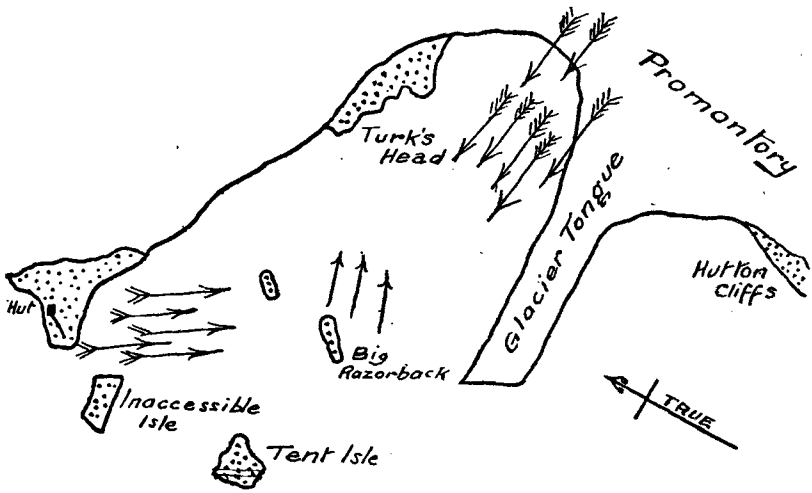
which overbalanced a gutter. Down this ran a lead ball which made contact and rang a bell! Further, the bell actuated a pulley and wire and made another contact whereby a red light appeared at intervals above his head! All this apparatus was made in the hut, and we never found out where certain of the "works" were hidden. Anyhow the bread was very satisfactory.

On the 17th April Scott took a party back by the same route to the Discovery Hut. Scott, Bowers, and Crean returned there, accompanied by Day, Nelson, Lashley, Hooper, and Demetri. Debenham and I went in charge of two ponies who were to pull the sledges as far as possible.

There was a fine moon, so that it was quite light at 8.15 a.m. We crossed several cracks, and I tested the ice with an axe. A moderate wind was blowing from the north—always a safe direction, for the blizzards invariably came from the south. The surface had improved greatly in the last few days, and the ponies had no difficulty in pulling along at about four miles an hour.

Erebus was clouded, but occasionally we could see a red glow when the mists dispersed. Rarely was there so much sign of *heat* visible, though the steam banner often spread out a hundred miles.

Opposite Turk's Head (six miles south) the wind changed



Changes in wind direction, March 17, 1911.

to a west breeze and then lulled, but a little further, near Glacier Tongue, there was quite a strong southerly, and we could see the drift sweeping over the promontory above Hutton Cliffs.

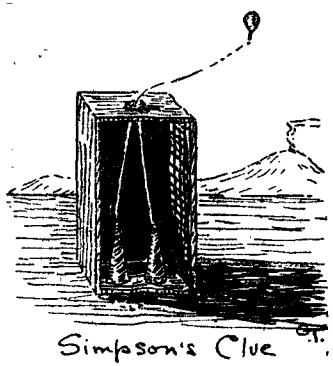
Here Scott sent the ponies back in our charge. The others marched on, and had a cold, rough time reaching the Discovery Hut. Their difficulties in climbing the ice rampart at Hutton Cliffs in the teeth of a smart blizzard is well shown in one of Dr. Bill's sketches in the *South Polar Times*.

A small villa had been erected in our absence, to carry the magnetometers. This was built of asbestos or similar material,

and held together by brass nails. It also formed a *camera obscura* for meteorological purposes. A lens in the roof projects the clouds on to a sheet of squared paper. This sheet is rotated until the clouds appear to move along a set of lines, and by comparing this with a compass the direction of their movement is obtained accurately and quickly.

That evening I helped to festoon the hut with telephone wires. While so engaged I saw my first aurora, and it did not impress me. "Like a huge broad cirrus cloud right across the sky from W.N.W. to E.S.E. No colour or movement, and it only lasted five minutes."

Wright and I assisted Simpson to send up a *ballon sonde*. This seemed a complicated business at first. We had to carry out a queer theodolite with the eyepiece inserted at right angles to the telescope at the side; and a large tank for generating the hydrogen; and the inner tube of a bicycle tyre—and various reels of silk, etc., etc.; not to mention a small tissue-like deflated balloon of red gutta-percha.

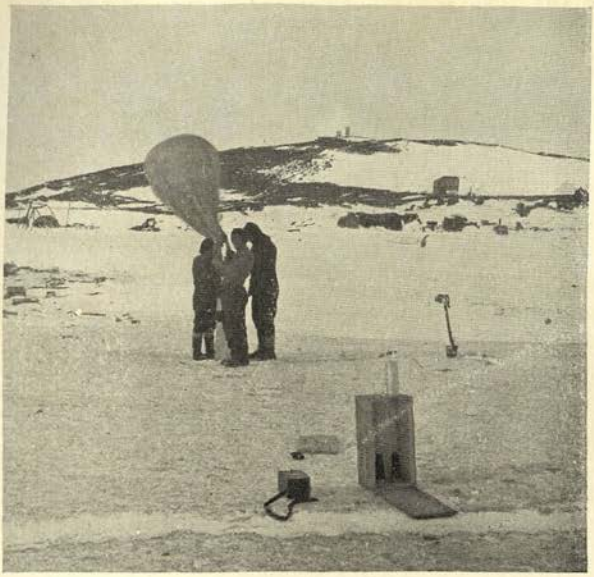


A sketch showing the balloon unwinding the black silk threads from the two conical reels.

The tank was filled from a convenient tide-crack in the sea-ice, and then Charles filled the cycle-tube with calcium hydride. This compound is analogous to carbide, but gives off hydrogen instead of acetylene. He attached it to the top of the generator, and squeezed it to push the lumps of hydride into the water. The balloon was attached to an outlet pipe, and gradually lost its dejected appearance and became a red sphere of some two feet diameter.

In about ten minutes the balloon was inflated. This was merely a test, and after tying a piece of silver paper on the balloon it was set free and rose rapidly. With the theodolite the vertical and horizontal angles could be plotted, and thus the path of the balloon charted approximately.

The sun was setting (at 3 p.m.) while we were doing this, and gave a yellow glow to the steam-cloud on Erebus, which was drifting to the south-east. When the balloon was about



SIMPSON SENDING UP A "BALLON SONDE," Nov. 12, 1911.

The meteorograph stands on the box. Inside the latter are the two conical reels of silk. In the background is the magnetic hut, the Grotto Glacier and Vane Hill.

THE EAST CORNER OF THE HUT SHOWING THE EDDY TRENCH SCOOPED OUT BY BLIZZARDS ON THE WINDWARD SIDE OF THE HUT, Sept. 14, 1911.

The stores annexe appears just on Clissold's right, and the "weather cupboard" on the right of the picture.

4000 feet up we could follow the flashing paper, and saw that here the air currents were opposed to the direction of the steam-cloud at 13,000 feet elevation.

The next afternoon there was a furious blizzard of fifty miles an hour, and a temperature of −7°. We kept to the hut, and made a start at winter occupations. I was busy writing a narrative of the western journey for Captain Scott. In this I proposed to discuss the physiography in some detail. When I had written twenty pages on the *first* day and a half, I wondered if the "Owner" would live through a report 840 pages long! Luckily the rule of three responsible for this forecast did not hold throughout!

Inside the hut the temperature was +47°. This was not exactly hot, and poor Ponting was delighted when some of the new-comers advocated lighting the small stove near his dark room. He said that developing photographs with water down to 47° was not the pleasantest job on earth. The blizzards hit his side of the hut, so that the inside of the dark room was festooned with icicles, giving it a most picturesque but uncomfortable appearance.

Things were getting straight in our cubicle. Our floor space was about eight feet by eight. We built a small table opposite the door and put shelves over this. Gran occupied a bunk over mine, and the legs of his wire bedstead hung over my head and feet, and caused many bruises at first. Debenham's bunk was raised six feet off the ground, and was supported on two stout wooden cylinders, on which the linoleum had been rolled. He climbed into it by a primitive ladder. His sea-chest was under the table, while mine half blocked the doorway.

On the rubbish-heap outside I found a small tin which served as my wash-basin. In this I kept a sponge, and normally it stood on my chest below Debenham's bunk. We were able to get about half a tea-cup of water if we found the cook in a good humour, so that it was rather a dry rub.

Secretly I was rather proud of my morning wash, but it did not seem to improve my appearance. I soon discovered the reason. Watching Debenham one morning before I arose, I saw him finish his ante-breakfast pipe and casually knock it on the edge of his bunk. The ash obeyed the laws of gravity,

and fell into my sponge with great accuracy, and as if it were accustomed to do so!

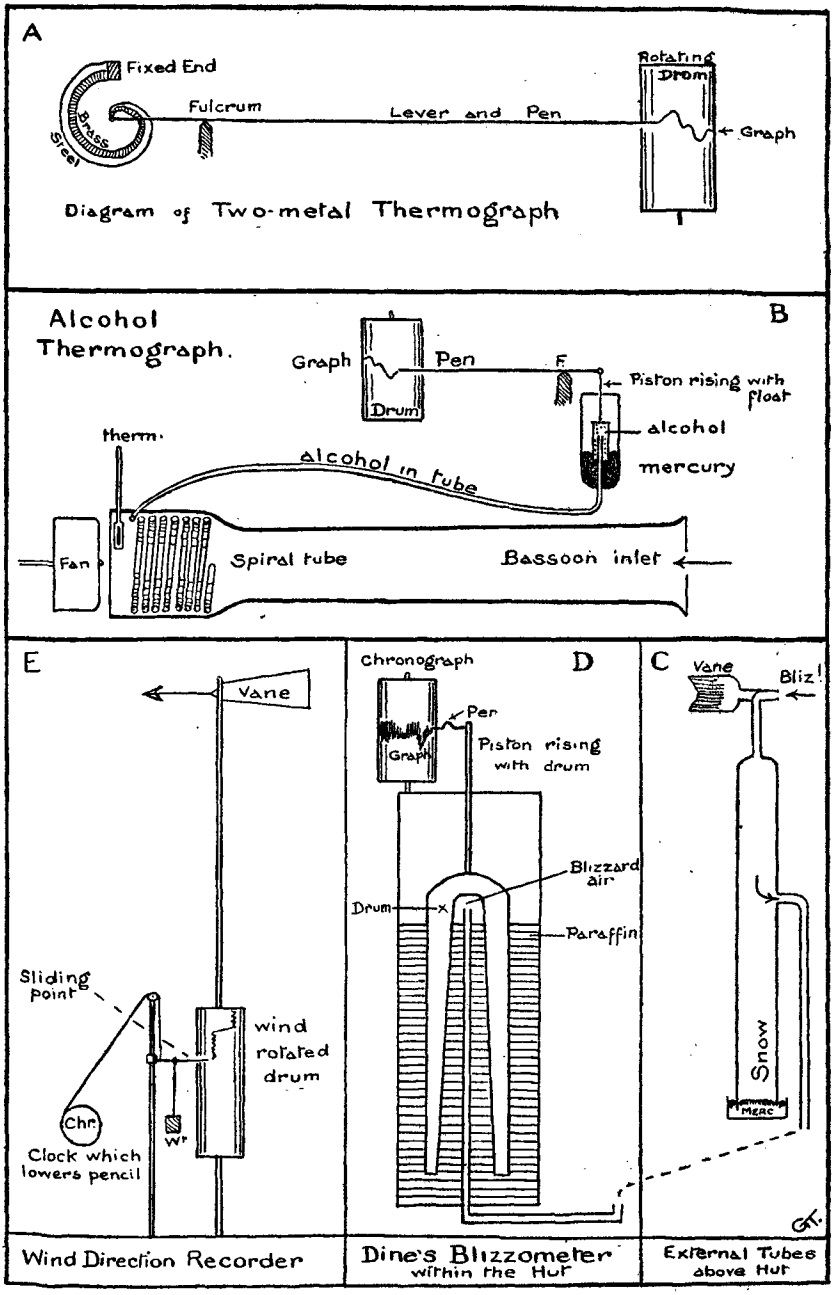
When the chest was thereafter freed from my ablutions, it was seized by Debenham as a petrological laboratory. For hours he might be observed rubbing down fragments of rocks on a glass plate with carborundum powder.

He had a microscope, and was able to examine the many thin sections thus produced without awaiting his return to civilization. It is most interesting to see a dark rock gradually becoming transparent as the section gets thinner. First the quartz and felspar show up like clear and milky glass, respectively. Then the green or brown colours of the mica hornblende or augite appear, while the characteristic green fringes to the clear olivine crystals or the absolute opacity of magnetite define those minerals. And then under the polarized light of the microscope even the colourless minerals show wonderful colours—from the pale greys and yellows of quartz and felspar to the vivid blue and purple of the olivine and pink and neutral tints of white mica.

Thus Debenham classified the numerous rocks from the western mountains. *Kenytes* rich in lozenge crystals of a beautifully banded felspar; *granites* showing brown cleaved crystals of hornblende and mica among the quartz grains and simple felspars; *basalts* with numerous crystals of olivine and magnetite in a felted mass of little felspar laths—gneisses, granulites, etc., etc., each and all can be pigeon-holed by picking out the relative proportions of the few minerals specified above.

By far the most interesting instrument in the hut—consulted by scientist and layman alike—was the "blizzometer." Such was the name we used for "Dines Pressure-tube Anemometer." We could all see a roll of paper on a rotating drum, on which a pen was always scratching lines giving wind velocity. But the expert could tell lots more. He could say not only how heavy each individual gust had been during the past twenty-four hours, but he could tell from the character of the graph whether the wind were from the north or south, and, more awkward still, he could tell when the night watchman had neglected his duty and let the inlet become choked with drift!

You could not bluff Simpson or the blizzometer. The



Copied from Simpson's diagrams at his lecture in the hut, June 3, 1911.

blizzard gave a thick series of vertical lines, so close together that a broad ribbon almost resulted. The north wind was never so strong, and the lines were shorter and less close together.

To understand the working of the blizzometer, let us accompany the night watchman. He has been engaged on his diary, maybe, till nearly midnight, when a complete set of observations are to be taken. He goes to the blizzometer to see what particular virulence of blizzard he has to face, and sees that the pen is motionless at the bottom of the paper—having dropped down after tracing gusts of sixty miles an hour. The night watchman feels depressed. He has to go and inspect thermometers and barometers and various other -ometers, but had hoped he would be spared "clearing the head" of the blizzometer. However, he wraps up well, and, carrying an electric lamp, ventures out round the south of the hut. He reads the thermometer at the most exposed corner, and then glances up to the roof-ridge and wonders whether he'll be blown off or not. In a sheltered nook he finds a brush of wires, and clutching this he climbs up a ladder to the roof. He feels the hut vibrating under the blizzard, and the drift shoots past him to the north. He clutches a metal tube projecting two feet above the ridge, and proceeds to prod the wires into its orifice, which faces the blizzard. A plug of drift snow breaks loose, and the wind once more drives freely into the nozzle of the blizzometer. It rushes down the tube into the hut and enters the base of the instrument. Here it passes under and into a metal bell floating in paraffin. The pressure raises this float, and of course raises a piston attached to it above. The piston passes through a gland to the outside and carries the pen at its upper end. Thus with every gust the piston (and pen) rises and falls, and a record is made directly on the rotating drum. The watchman warms his hands inside his jacket, and when feeling has returned to them he trudges into the hut, and devoutly prays the "head" will remain unchoked all night.

At this period our hut interior looked neat but not gaudy. Later, the continual tramping in of boots carrying snow and gravel, somewhat detracted from the neatness; but luckily, in the absence of brilliant illumination, no one was perturbed by the accumulation of "matter in the wrong place" which soon

collected in the corners. But one object in the hut looked rather incongruous, and that was the Broadwood Pianola, lent us by the Broadwood Company. It was intended to keep this on the ship, but our unloading was done so successfully that some time could be devoted to transhipping the pianola. By dint of dismantling the wardroom—removing the stairs bodily—Rennick and his assistants managed to hoist the pianola on deck, and so got it eventually into the hut.

We were a strikingly unmusical crew. Ponting on the banjo and Nelson on the mandolin were the best. No one but myself ever used the piano. I had three pieces of music and speedily lost one—it was found under the pianola buried in grime six months later,—so that there was rather a sameness about my performance. I grieve to state that my two pieces became less rather than more popular as winter advanced!

However, I rather thought I might shine as a pianola player, and started to practise as early as April. After listening for some time, my scientific colleagues, who occupied bunks immediately back of the pianola, were moved to remark, "For Heaven's sake, Griff, give that a miss, and let some one play who can keep time!" Perhaps I should have persevered, but they could throw too straight, and I never attempted pianola-playing again.

On the 21st Scott returned from Hut Point, leaving Meares, Nelson, Day, Forde, Keohane, Lashley, and Demetri in the 1902 hut with the ponies.

They had had bad weather going—as I expected. Very thick drift hampered them, and the new chums, especially Hooper, had been severely frostbitten. The latter had two angry red sores on his neck where the blizzard had caught him between his helmet and jersey. To climb the cliff at Hutton Cliffs they had to empty a sledge. Crean and Lashley held it up at arms' length like a ladder, and Scott managed to climb up it, and cut steps over the cornice. They reported that the others expected to stay a fortnight more, and they augured badly for the commissariat under Meares, because "he's so very sparing with the butter!"

Ponting kindly developed my western negatives in his dark-room. They were no worse than I expected, being, however, all rather thin. Half a dozen were broken, and I had

improved on a common error by putting *three* on one plate. We had such a rush before starting our journey that neither Debenham nor myself could test a single plate under Antarctic conditions. It seems simple now, but we had many failures before we gauged the best method. Previous Antarctickers had recommended plates and not films. I now disagree with this advice *in toto*, at any rate for sledging. We broke the plates. They scratched easily. Changing them in our bags was an unmitigated nuisance and filled the dark slides with hairs. Lastly, the glass plates weighed so much that they were always left behind when we had to cut down weights.

We had an idea that the quickest exposures would be advisable with snowscapes. Ultimately we took most of them at half a second or thereabouts!

A typical scene would largely consist of a skyline of snow mountain backed by a blue sky more or less covered by grey or white clouds. The foreground was usually also snow with bluish shadows. Everything was blue or white. There was little contrast, and owing to the photographic value of *blue* being almost the same as that of *white*, the resulting photograph was of a dismal flatness and one could not distinguish land from sky.

Of course this pointed to yellow screens to cut out all blue and give it the effect of black. We had much better success thereafter, but this necessitated the slow exposures I have mentioned previously.

My chief camera was a Zeiss Minimum Palmos equipped with all modern features, taking telephoto pictures, stereoscopic, ¼ plate or panorams (7½ inches long). It had a focal plane shutter calculated to give $\frac{1}{1500}$ of a second; but the rubber shutter froze stiff, and my exposures were largely made with a red handkerchief presented to me by Wright.

At the east end of the hut Ponting was busy at a huge instrument which looked like a cross between a barrel organ and a butter churn. It was really a "washer" for cinema films. The films were wound on a cylinder, placed in the washer, covered with a lid, and then rotated by a handle. When this operation was finished we all admired Ponting's ingenuity, for he emptied out the water and placing a rug inside the hybrid, converted it into a most comfortable lounge chair.

The 23rd was Sunday, and Scott held Church service as

usual. He and Dr. Bill would consult as to the hymns, and Bill acted as choir-master. He and Scott would test the key by striking several notes on the pianola before service. Then just before we started the hymns Bill would sound the note again and Scott would lead off with the first line. He had a tenor voice and could sing much higher notes than most of us, and made no ado about remarking, "We'll have this a few notes higher," between the first and second verses.

Early in the winter Dr. Atkinson started physical measurements, which were always the source of much interest and amusement. They were taken every alternate Sunday or Monday, and a list of the figures for those present on the 24th April may be of interest.

In addition to ordinary measurements, tests of the grip by the dynamometer and breathing power by the spirometer were also recorded. In the former an oval spring-frame is compressed and a rachet and cog actuates a finger which indicates the grip. The spirometer consists of a small enclosed vane which is blown round by the pressure due to one expiration.

I got the heights of the officers and recorded them on the wall of the "owner's" cubicle. The other measurements are given in the table herewith.

APRIL 24, 1911.

Name.	Height.	Weight.	Dyn^{r}.	Waist.	Arm.	Chest.	Spir^{r}.	Calf.
	Ft. in.	Stone lbs.		Ins.	Ins.	Ins.		Ins.
Captain Scott	5 9·05	11 6½	320	30½	14¼	39¼	294·5	15½
Dr. Wilson ...	5 10·5	11 0	275	29	13	36	287·3	15¾
Lieut. Bowers	5 4	12 0	280	32¾	13⅛	40	230	16⅛
Cherry-Garrard	5 9½	11 6	300	30	13¼	36¾	267	15
Atkinson ...	5 6·75	11 0½	270	30	13⅝	36¾	265	15¼
Debenham ...	5 8·4	11 0½	305	29½	12½	38¼	261	13¾
Taylor ...	5 10·6	11 7	350	33¾ *	13	36½	307	14¼
Ponting ...	5 7·5	11 2½	275	30¾	14¼	37	238·5	14¼
Oates... ...	5 9·35	12 4¾	270	31½	13½	40	266	15¼
Evans ...	5 6·85	11 13	350	34 *	14	40½	270	15¼
Gran... ...	5 11·05	13 3¾	300	31½	12¾	40	335	15½
Wright ...	5 10·8	11 12	345	30½	12¾	38	329	14¾
Simpson ...	5 10·95	11 2¾	260	30	13	37	308	13¼
Day, Nelson, Mears }	absent at Hut Point.							

* The waist measurement caused great amusement. Evans and I were

Wilson, Bowers, Taylor, Ponting, Gran, and Meares were non-smokers, and Wilson, Bowers, Taylor, and Simpson were teetotalers, though several of the others swore off alcohol except on high days.

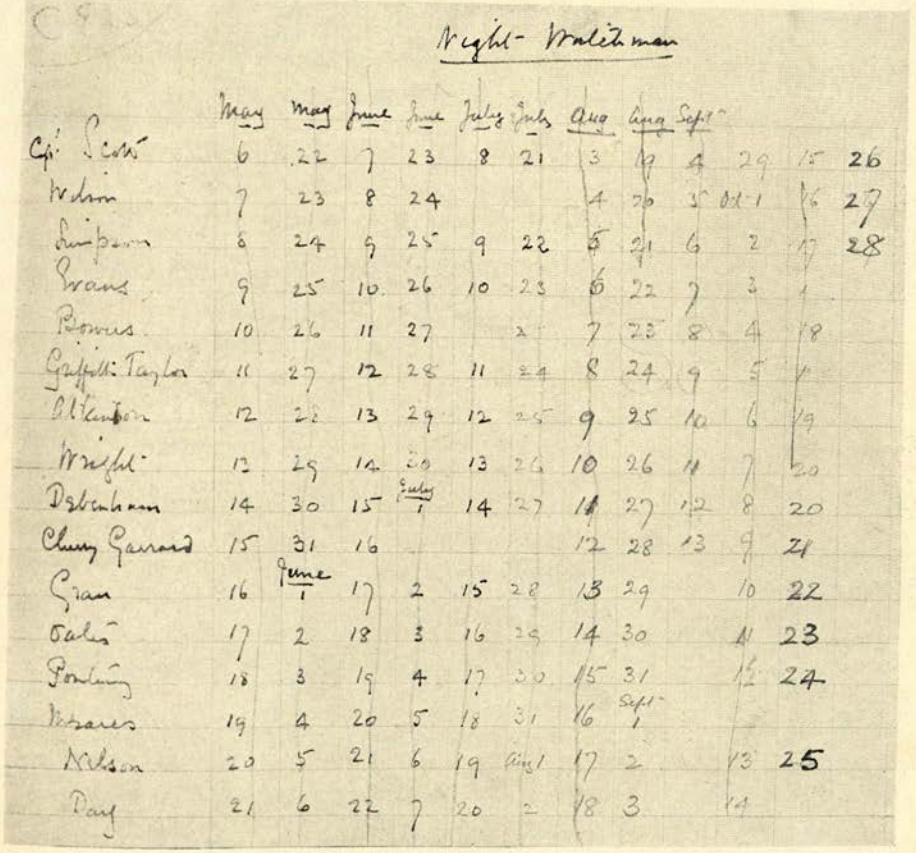
At noon the northern and western sky was very beautiful, and I made an effort to record the colours by means of chalks in my diary. The dominant note was yellow shading to lemon-green in the west. Over the western mountains was a rose-pink flush verging into lilac-grey through salmon-red. To the north the band of salmon-red flanking the yellow changed into slate-blue and pale blue overhead. The sun's rays shone gold through clouds over the Barne glacier, which exhibited magnificent purple and blue shadows.

It is sad to think that Bowers' sailor-like criticism of the magnificent study in reds and yellows was that it reminded him "of a mess of eggs that had carried away," meaning thereby a dish of fried eggs which had been upset.

Captain Scott instituted an aurora watch on this date. It was desirable to discover if periods of great magnetic disturbance (as shown by the magnetometers in the ice grotto) were accompanied by striking displays of auroræ. There were fifteen officers in the hut, so that each man's turn came along about once a fortnight. He was to go out at every hour and sketch the aurora if present, and of course attend to the meteorological instruments, inspect the ponies, keep up the fire, and generally mount guard from 8 p.m. to 8 a.m. A feast of sardines heated on a bunsen burner was promised to the gallant watchman.

The most imposing objects near the cape were the stranded icebergs. Ponting and I walked across to them in the afternoon. First we reached the Arch Berg just before it fell in and became the Castle Berg, the Arch Berg, in which the major portion of the arch had fallen, leaving only a narrrow elevated strip uniting the two moieties of the berg. There was a magnificent view, looking back at Erebus through this white

measured first, with the result above recorded. Wilson came next and basely proceeded to constrict "little Mary" to an incredible extent, so that he had apparently five inches less corporation than Evans and myself. Every one else followed suit, and many were the jeers at our expense. However, I got Gran to measure me according to Wilson's method, and dropped to 30¾ with ease!

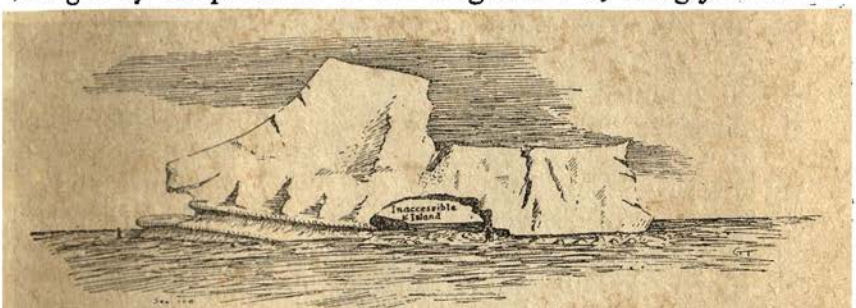


CAPTAIN SCOTT'S AUTOGRAPH LIST FOR THE AURORA WATCH.

arch, and Ponting promised himself some particularly pleasing views when the sun returned.

Later we went over to the tunnel berg, which Wright and I surveyed in January. It had also broken up, and had tilted up some twenty feet on the southern side, owing to readjustments in the equilibrium. The once vertical tunnel was now only half its length, and lying at an angle of 45° (see Fig. p. 97).

Two seals were lying in the lee of a small berg near by. As we approached they took to the mushy water immediately surrounding the berg. They lay there on the sea ice submerged by the pressure of the berg above it, being just under



The Arch Berg just before it fell in and became the Castle Berg, April 27, 1911.

water, and not worrying to get through the ice into the Sound beneath.

Later in the day a wandering Emperor was led in by a strap round his neck, and I held his wings while Dr. Bill pithed him by a lancet in the brain.

"The last bunk has been added by Oates. He brought in some boards from the stables—not needed now owing to the decease of the six ponies—and has built an erection which presumably satisfies him. We all remark that it is only held up by a small plank nailed to Bowers' bunk; but Oates is quite imperturbable as usual, and no whit disturbed by ribald remarks as to a 'deadfall' trap baited with oats."

I had been reading Cherry's set of Kipling, and there was such a clatter of talk from our rivals across the hut that I publicly christened them the Banderlog. Birdie retaliated by criticizing my pronunciation; but I said I had no objection

to calling them the "Bunderlohg," and did so for the rest of the winter.

Debenham fixed up a terra-cotta curtain across our entrance which had been presented by Ponting, and now we were hidden from the vulgar gaze, though one frank critic said our sanctum looked like nothing so much as an opium den. Day had run in a branch acetylene light, and Debenham had stained everything stainable a dull red-brown with that beauteous dye, "Condy's Fluid." Not to be outdone, Gran fixed red linen borders on the shelves made from photographic "window" material, while I draped my bunk with a deep blue hanging, which had originally formed part of the Sunday tablecloth. We put down all captious remarks to jealousy; and the "Ubdugs" were more secluded than any other coterie in the hut.

Immediately north of Cape Evans the coast-line consisted of alternating rocky crags and snow-drifts, but about half a mile away this gave place to the vertical wall of the Barne Glacier. In places this ice barrier rose to 180 feet, and was fissured with crevasses from which frequent falls took place. These varying features were named later on, and Wright, Debenham, and myself were never tired of examining the silt bands, and included blocks, crevasses, debris slopes, etc., which characterized the vicinity of High Cliff.

The summer sun acting on some of the dark boulders included in the ice face had etched them out until they appeared like giant gargoyles projecting three or four feet beyond the general plane of the ice wall. I made a rough pencil sketch of these "gargoyles," and on my return to the hut asked Dr. Bill to show me how to improve on this attempt.

On the 27th an important institution was inaugurated, which was afterwards called *Universitas Antarctica*. Captain Scott had sounded Wilson, and then he called up Simpson and myself and asked us if we would be willing to help carry out a scheme of winter lectures which he had drawn out.

We had a notice board on the side of the "Owner's" cubicle, and on this he appended the following notice:—

WINTER LECTURES.

Some members of the community have very kindly consented to give a series of lectures during the forthcoming winter, the programme of which is attached hereto.

These lectures are arranged for each week, to be given on Mondays, Wednesdays, and Fridays, after the evening meal.

It is proposed that each lecture should be followed by a discussion, conducted on ordinary debating lines, and regulated by myself as chairman. The time occupied by the lecturer will be about one hour. It it not thought advisable to attempt to impose a time limit on the subsequent discussion. Attendance at lectures is purely voluntary, and neither the lecturer nor the chairman will feel aggrieved if any person prefers to read a novel or otherwise employ his time.

WINTER LECTURES AND DISCUSSIONS.

		Subject.	Lecturer.
Monday,	May 1.	Antarctic Birds	E. A. Wilson.
Wednesday,	„ 3.	Halos and Auroras	G. C. Simpson.
Friday,	„ 5.	Physiography	G. Taylor.
Monday,	„ 8.	Future Plans of the Expedition...	R. F. Scott.
Wednesday,	„ 10.	Illustrated Lecture	H. G. Ponting.
Friday,	„ 12.	Mineralogy	F. Debenham.
Monday,	„ 15.	Penguins	E. A. Wilson.
Wednesday,	„ 17.	Management of Horses	L. E. G. Oates.
Friday,	„ 19.	Ice Problems	C. Wright.
Monday,	„ 22.	Evolution of Sledge Rations ...	H. Bowers.
Wednesday,	„ 24.	Parasitology	E. L. Atkinson.
Friday,	„ 26.	Biological Problems, I.	E. Nelson.
Monday,	„ 29.	Illustrated Lecture	H. G. Ponting.
Wednesday,	„ 31.	Tips on Sketching	E. A. Wilson.
Friday,	June 2.	Meteorological Instruments ...	G. C. Simpson.
Monday,	„ 12.	Surveying	E. R. G. R. Evans.
Wednesday,	„ 14.	Volcanoes	F. Debenham.
Friday,	„ 16.	Biology II.	E. Nelson.

Also Motor Sledging (Day); Whales (Wilson); Midwinter Illustrated Lecture (Ponting); Physiography II. (Taylor); Horses II. (Oates); General Meteorology (Simpson); Beardmore Glacier (Taylor); Radioactivity (Wright); Scurvy (Atkinson); Lantern Lecture (Ponting).

The Cape Crozier sledging party probably leaves on July 1. The programme for the remainder of the winter will probably be regulated according to this and other circumstances. It is hoped that the lectures

named below can be duly arranged, so that every one may have an opportunity of hearing and discussing them.

Central Asia (Meares); Magnetism (Simpson); Constitution of Matter (Wright); Mineralogy II. (Debenham); Physiography III. (Taylor); Biology III. (Nelson); Bacteriology (Atkinson); Evolution of Polar Clothing (Bowers); Seals (E. A. Wilson); ending on September 1st.

(Signed) R. F. Scott.

Three lectures a week rather terrified some of the party, and it must be admitted that when a lecture was "on," there was not much room for private reading! Anyhow, none of the officers ever absented themselves. The seamen attended the first two, but most of them "gave it a miss" thereafter, being probably intimidated by the title and probable aridity of the third lecture, "Physiography, by Griffith Taylor."

To the south of Cape Evans extended a long and narrow belt of cliff hemmed in "betwixt the glacier and the deep sea," which we called Land's End. This extended about a mile; and thereafter was a face of glacier ice for four more miles similar to, but not so imposing as the Barne Glacier face.

Gran reported marvellous ice caves beyond Land's End, so Ponting, he and I went off to investigate them. When we reached the crevassed face we found that the caves were really the exposed ends of crevasses. However, this seemed much the best way of entering a crevasse, so we crossed the mushy tide-crack and passed through the narrow entrance which was half blocked by a tree-like mass of ice. At the back a huge Stonehenge pillar supported the roof, and outgrowths from the walls were connected to the flat floor by huge stalactites. Sticking promiscuously to the central column was a slender slab of ice, which seemed to indicate that there had been no movement of late, or it would have fallen. This was comforting, for Ponting made me "pont" in the interior for several minutes while he tried a flashlight. Near by I spotted a crack in the ice face covered by ice stalactites cemented together. I chipped out an entrance till it resembled what cave-explorers call a "fat man's misery," and then squeezed inside. It was another pretty little cavern, and the colouring was very striking. "The most magnificent

blue light filtered in through the outer wall, as vivid and glowing as it is possible to imagine."

Cherry-Garrard now began his most arduous winter employment as Editor of the *South Polar Times*. He had brought down a typewriter, and proposed to continue the Antarctic publication, of which two volumes had already appeared in 1903–4, in Scott's First Expedition. His notice read as follows :—

NOTICE.

South Polar Times.

THE first number of the *South Polar Times* will be published on Midwinter Day.

All are asked to send in contributions signed anonymously, and to place these contributions in the box under the looking-glass as soon as possible. No contributions will be accepted for this number after May 31st.

A selection of these will be made for publication.

It is not intended that the paper shall be too scientific. Contributions may take the form of prose, poetry, or drawings. Contributors whose writings lend themselves to illustration are asked to consult with the Editor as soon as possible.

The Editor,
S.P.T.

A tin receptacle was nailed under the notice board, and labelled the Editor's Box, and Cherry set to work on his editorial pending the avalanche of contributions. Three issues appeared in 1911, and one other in 1912, but I shall describe *S.P.T.*, as it was familiarly termed, in greater detail later in the narrative.

I commenced duty as night-watchman on the 28th. I used to spend some of the long hours in writing my journal, so that there is never any dearth of notes of what happened about that period !

I wrote on this occasion, "It is not the sinecure that I imagined. Primarily I have to go out every hour and observe the auroræ. If they are really on tap, I have to stay on Wind Vane Hill (a quarter of a mile off) till they're over ! (I hope it stays overcast !) There was a fine display at 9 p.m. Sunny Jim had taken me out to see the spectroscope test. Behind Erebus it was going strong, and I could see a bar in

the yellow-green of the spectrum which is particular to auroræ. I wrote the following in the log-book :—

> "'At 21.10 (=ten past nine) a fine display along the whole sky behind the Erebus mass. At first isolated greyish streamers reached over 8°; they had a reddish tinge, but were not bright enough to give a bright line in the spectroscope. The whole brightened until almost a continuous band of (almost yellowish) light. It concentrated with a movement to the north, reminding one of a caterpillar's motion as the more vivid mass of light undulated towards Erebus. At one moment it clotted into a globule of light not unlike a meteor, pointing to the crater with a streamer extending up, and slightly to the south. There was a tendency for the more northern streamers to point the same way. At 21.16 the display was over. There was perceptible orange and traces of purple (*fide* E. A. Wilson) in the borders. During the maximum, the streamers were over 20° from the horizon.'

"Clissold and Birdie retain me to keep the fire going in the galley. I put coal on twice (say at 2 and 4 a.m.) and rake out the ashes at 6 a.m. Wake the cook (Clissold) at 6.30. Wright says look to the acetylene apparatus. If it gets below 32° F. in the porch, open the inner door and let in a whiff to the mess deck! If the drum rises three feet and there's risk of explosion, pump out the water, if vice versâ dump in some water, for the bell won't work. Teddy Evans is to be waked at 7 and Sunny Jim at 4 and 7.30.

"I intend to have a bath when Scott and Evans turn in. The former is reading and the latter plotting Inaccessible Island—a scandalous proceeding at 12.30 a.m.! For my bath I have to get ice from the old tin bath outside and replenish the galley boiler. I tried to get tinned fruit for my 4 a.m. repast instead of sardines, but it was no go! I can boil water on the little acetylene bunsen, if it's worth doing."

Later.—"I have sketched the N.E. corner of the hut, and tried to write a poem and failed. Been out five times and seen no auroræ. Had a hot bath and filled the boiler with ice. Stoked up the fire and examined the acetylene plant.

Sunny Jim awoke at four. Finds something wrong with the ice grotto lamp, but has gone off to sleep. The temperature in here is +49° F. There is bread and butter, sardines, and possibly cocoa awaiting me. Clocks tick everywhere, and wriggles and snores are universal. I am yawning my head off."

Later.—"I turned in at 7 a.m., so ending my first watch, and stayed till 11 a.m. cutting breakfast."

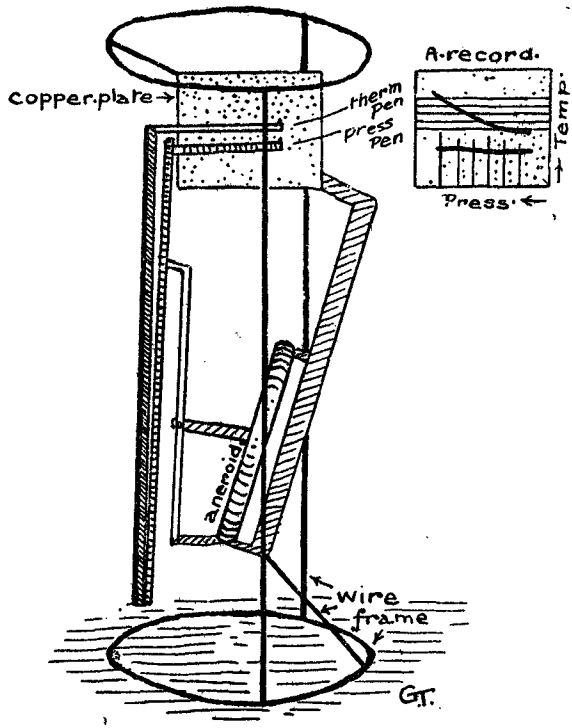
I helped Cherry to build a stone hut on the beach before lunch. The weather was quite calm, and yet before we had finished the meal there was a furious blizzard blowing up to fifty-six miles an hour—gale strength being thirty-eight miles. It lasted just twelve hours, but the sudden rise was very characteristic.

One morning Captain Scott summoned a council of Dr. Bill, Teddy Evans, and myself to christen officially the main features of our winter quarters. The officers who had spent the summer on the Cape had already named some of the beaches and lakes. Teddy Evans had started surveying, and fixed stations on outlying points, while the geologists had cruised about the moraines to the east and so had some knowledge of the topography there. Land's End and Seal Rock for southern features were agreed to. The two lakes kept Nelson's names of Skua Lake and Island Lake. The hill where the screens stood was changed from Vane Hill to Windvane Hill. North Bay and South Bay were obvious, if not novel. Oates's pursuits were considered in the names of the lowlands near the hut, for these were named The Paddock and The Course. I begged that the rugged crest across the S.W. be called the "Backbone," but I never heard any one use the term! Finally the steep scarp 150 feet high and continuous from High Cliff to Gully Bay came up for discussion. Scott said, "Now this is why I summoned you, Taylor. What do they call this in Physiography?" I could think of nothing but "scarp"; but Scott gave it the euphonious name of the Ramp. "Going up the Ramp" was one of the commonest remarks during the succeeding months. Part of the Ramp to the north was a sheet of snow and ice, and for this I suggested Slippery Slope; while, later, a series of steps I cut up the face was known as the Golden Stairs!

Later in the day Wright and I filled a balloon which

Simpson and Bowers let off. The procedure was now more elaborate, and in place of merely testing wind direction the balloons carried up a meteorograph and miles of fine silk thread.

In a small aluminium cylinder about eight inches long is contained a small aneroid (for pressure and height) and a small two-metal thermometer. Levers attached to these scratch two fine lines on a copper plate, and by suitable enlargement these



Balloon Meteorograph

lines give the temperatures at varying heights. The black silk unwinds like a Penelope thread and trails after the balloon. After some minutes a fuse burns through and liberates the balloon. The meteorograph falls to the ground with its record.

Theoretically all one had to do was to follow the silk and pick up the instrument. Actually it led one to the water's edge and there vanished, or crossed the seracs and crevasses

of the Barne Glacier and vanished again; or, worse still, started southward, and broke in the first quarter-mile on the rugged blocks of kenyte on the Cape! Simpson and Bowers were indefatigable in searching for the graphs, and recovered about half of them, often walking ten miles to get a record. A notice that any one finding a meteorograph would be presented with a box of chocolates resulted in no great diminution of our store of that attractive comestible!

It was good fun sending up the meteorographs in the earlier months, and the vagaries of the balloon gave rise to much chaff among the operators which in naval parlance is called "hot air." It was an excellent school for "rounding off rough corners," for each member had his mannerisms so dinned into him that he could not be said to err in ignorance.

On the 1st May Dr. Bill gave the first lecture on Flying Birds of the Antarctic. It was postponed from 8 p.m. till 8.15, while the sailors (in the "mess deck") washed up! The ribald youth spent the quarter-hour drawing "dicky birds," which we passed along to Dr. Bill to keep his mind occupied, and so save him from stage fright.

Dr. Bill shut off suddenly at 8.45, to the Owner's pretended amazement. The discussion lasted till nearly ten, each man being called on by Scott in the order in which he happened to sit at the table.

As the birds have no enemies down south their white colour did not seem necessary for protection. I suggested that it was because white plumage would radiate out less heat than black (which seemed to recall some old physical experiment I had done!). Oates said, "Talking about birds, why were all Shackleton's ponies grey?" Bowers wanted to know how the second skua chick was killed in its first week. Did its brother gobble it up? Ponting instanced an example of more than two in a clutch. He had photoed a chicken and two eggs in a nest near the hut last January! I inquired into this phenomenon which interested Dr. Bill much, and after some minutes broke it to Ponting that I had done the deed, taking pity on a motherless chicken and placing it in a warm nest near by! A yarn that amused them was an experience in the islands off South Australia. Here 5000 young cormorants were slain by an adjoining colony of terns in a few hours. Where were the parent cormorants? asked

some one. They had all abandoned their offspring at sight of the visiting members of the Australasian Association!

On the 2nd May we held our first football match. The game was "Soccer," and curious was the composition of the teams. There was little five-foot Anton, our Russian groom, who knew no English and probably had never seen a football. Somewhat of a contrast were Crean and Taff Evans, about six feet high, and two of the biggest men in the navy. Moreover, Evans was a noted Welsh player. Wright's knowledge was based on ice hockey. I had played rugger in 1905, and now found that the rules differed considerably. Atkinson was our star player, though Gran had played football for Norway.

We played on the sea ice in North Bay, which was still badly cracked, and not very thick, so that there was a chance of our game being a moving one in several senses!

I dare not give my opinion of the game. Every one seemed to be offside; the more so the better. I followed hard on the ball, which later I was told was inadvisable. Anton got one idea into his head, and merrily kicked the ball to the middle of the field wherever he happened to be. At half-time a blizzard started, and helped our side materially. I had on windproof jersey and singlet, but as there was forty degrees of frost I did not get particularly hot. In fact, I could feel my arm "going" every time I stopped running, which was unfortunate, for I had a collision with Crean which took the last of my wind. Scott was playing just behind me, and was very urgent that I should follow him up, but grinned cheerfully when I said I was too winded! The blizzard nearly blew the ball off the ice. It rose to forty miles per hour, but there was little drift, and it stopped when it couldn't help our side, so naturally we won by three goals to *nil!*

Lectures alternated with football, so that next day we heard a very interesting lecture from Dr. Simpson.

LECTURE ON METEOROLOGICAL INSTRUMENTS.

By Dr. Simpson.

June 3, 1911.

On the 3rd June Simpson described very clearly the various meteorological instruments in use at Cape Evans. He illustrated his

lecture with simple diagrams, which are reproduced in the figures on p. 221.

He started with an amusing instance of error in measurement. It is an obvious principle that the measurement itself must not alter the condition of the experiment. Thus, if you want to know the length of your own trousers, you introduce an error if you bend down to measure them!

There are three methods of measurement in general use—by photography, by moving a lens, and by various mechanical methods. Lastly, the time must be accurately recorded, and this is usually done by a chart carried on a rotating drum, which is clock-driven. The whole apparatus being called a chronograph.

In determining temperatures we need that of the air itself, and we must eliminate the direct effect of radiant heat. Thus a thermometer placed near a newly kindled fire records the access of heat long before the surrounding air is warmed by the fire. Hence we must bring a large quantity of air into contact with the thermometer. The method while sledging is to use a "sling-thermometer." Here the thermometer is enclosed in an aluminium case of which the opened lid forms a handle, by which the thermometer can be swung rapidly for some minutes in the air.

In self-recording thermometers it is more usual to suck a large quantity of air past the thermometer by means of a little fan, as shown in Fig. B.

If, however, a check is kept by frequent comparisons with standard thermometers at the same place, this is not necessary. Thus the thermograph at Wind Vane Hill consists of a bimetallic coil fixed at one end, as shown in Fig. A. The inner strip is of brass, the outer of steel. When the temperature rises the brass expands most and straightens the coil, thereby deflecting the lever and pen, and so marking a graph on the rotating drum.

Another form of thermograph is shown in B, which was placed just at "Simpson's corner." The large brass bassoon and copper coil were outside the hut in the "weather cupboard," while the small float and drum were inside the hut. The air drawn into the bassoon by the fan affected the volume of the alcohol in the copper tube, and so raised or lowered the little float, and so actuated the pen. It needed to be checked also by frequent comparisons.

To determine wind velocity we had several instruments. On the hill were the Robinson Cups, which whirled round merrily and were registered by clockwork. Every six miles there was a signal sent electrically to a chronograph inside the hut. Here we had a more unusual instrument, called in full the Dines Pressure Tube Anemometer, but early named the Blizzometer. Its records, owing to its more sheltered position, were one quarter lower than those on Wind Vane Hill.

On the roof two vertical tubes were visible. One pointed into

the wind, and another (not shown) pointed away from wind, and was worked by its suction effect. The outer tube is sketched in Fig. C, and the lower end of this long pipe communicated with the blizzometer inside the hut. A practical experience with the blizzometer in a blizzard is given in another paragraph (p. 222). Since the resulting pressure varies as the square of the velocity, it is necessary to arrange the inner capacity of the drum to suit. It has, therefore, a paraboloid vertical section (being wider lower down), so that the heaviest gusts do not raise the piston (and pen) disproportionately high on the graph. The essential details of the apparatus are shown in Fig. D, the instrument being about a yard long. In Fig. E is shown the ingenious method for obtaining a continuous record of wind direction. The wind vane on the roof as it swings twists a cylinder on the same axis. This cylinder was situated in the porch in close proximity to the acetylene plant, over which we had to climb to regulate the instrument. On this cylinder was wound a sheet of metallic paper. At the side was a sliding point which made a mark when pressed on this paper. It was actuated by a clockwork which gradually lowered the point to the bottom during a period of seven days. With a steady wind a vertical ribbon was marked on the chart, and in our case nearly all the marks were confined to the south-east or north quadrants.

Simpson next proceeded to explain the instruments for detecting the electrical condition of the air. This was merely a variant of the quadrant electrometer, which is rather too technical an instrument for the layman. The magnetic measurements are also open to the same objection. The Dine's Meteorograph is, however, a very ingenious instrument, and I have given an account of it in a preceding section (p. 234).

There was a crowded and enthusiastic audience, and the experiments were most striking in view of Simpson's limited material. As a preliminary Ponting nearly blew us up with his acetylene lantern, and canny Dr. Bill sought shelter under the table!

In the second football match, I tried the effect of wearing light American shoes in place of heavy ski-boots. I don't think it improved my speed much, though I managed to give Crean two "busters," which pleased me greatly. Simpson did not appear, and later we found that Wright had seen the door of the magnetic hut unfastened, and had locked it while Simpson was within! My tight thin shoes naturally made my toes "go," but by diligent rubbing and gradual warming before I entered the hut I managed to bring them back without any great pain.

My first lecture was on the principles of physiography. Dr. Bill assisted me to draw some sketches on large sheets of paper, which I pinned on the pudding-board. This rested against a chair on the table, and was lighted by our acetylene branch! Cherry drew a sketch of the author and pinned it on the gas-jet as a screen. I discussed the evolution of a land surface from an "infantile" plain, such as that of Red River, Canada, through various stages of uplift to the "senile" condition of a peneplain.

I had made several small models in plasticene, and believe the lecture was fairly successful; for Simpson said he started sleepy and ended wide awake!

I based most of my lecture on my recent work on the geology of the Federal Capital Territory in Australia, and the substance thereof is given in the following paragraphs. This region (about 100 miles each way) illustrates almost all the new concepts in the evolution of a land surface.

Before the faulting the rivers flowed over fairly open country as the Upper Yass River does now. The Murrumbidgee River rose on the north of the Tindery Range and the Snowy River on the south. An ancient fault plane assisted the Murrumbidgee to capture the snowy tributaries at Tharwa. The country was broken by two main north-south faults. Thus the head of Yaas River was cut off to make Lake George. Molongolo River managed to saw its way down through the scarp (as it rose) and so formed the Molongo Defile. All the old snowy tributaries (Upper Murrumbidgee, Gudgenby, etc.) preserved their southward direction as they cut deep gorges in their uplifted beds. These tributaries form "boat-hook" bends where they join the big river. The present divide at Cooma is an insignificant wind-gap.

The old river-bed draining the Lake George area (which is seventeen miles long) is preserved as a deposit of huge quartz boulders two hundred feet above the lake at Geary's Gap. This may be termed a "*dead* river." The silts of Lake George are still being added to, and hence this country is *below* base-level, and may be described as *embryo* topography. The narrow gorge of the Molongo and those of the Cotter and Gudgenby exhibit *infantile* erosion features. The lower Molongo River flows through a deep but wider valley with

a *youthful* facies. The Yass River is flowing through undulating or *mature* country. The Upper Molongo, winding over a dead-flat plain of silt (held back by the rock bar at the defile) is meandering over *senile* topography. In every case the cross-section of the valley gives the key to the method of its formation *and date* of its present form.

After the lecture Captain Scott's attitude was rather amusing. He said physiography was too novel to accept at once, and he would like to hear if it agreed with the teaching of older geology? Dr. Bill was very cordial, and said the onus lay on the geologist to disprove the tilting and faulting which I had instanced in the Australian federal territory.

It is a point of some interest as illustrating the growth of a special physiographic outlook, that I had quite forgotten to mention the *geological deposits* above Lake George, which corroborated the evolution of the surface as deduced by pure physiographic reasoning!

Simpson discussed the question of the rain factor in physiography, so I told them about our gigantic rain gauge in Lake George, near Canberra. This is about twenty miles long and five miles wide. At some periods it is thirty feet deep, and contains murray cod several feet long. Again—as at present—it is covered with grass, and inhabited by sheep and less desirable immigrants in the shape of rabbits and foxes.

Next morning I was very pleased at a kindly remark of Scott's: "Taylor, I dreamt of your lecture last night. How could I live so long in the world and not know something of so fascinating a subject!"

Atkinson had been having successes with the fish-trap, and I went out with him to see the sport. We tramped about half a mile over the ice to the north-west. Here was a hole in the ice three feet across. It was filled with new mushy ice, but we soon chipped this out and flung it to one side. Then we hauled at the rope and pulled up the trap. It was a cylinder of wire netting about three feet long with re-entrant ends, so that the fish could enter at the centre, but (nosing along the walls) had not sense enough to get out again. It showed beautiful phosphorescence as it rose out of the water, for the days were, of course, quite dark now.

There were twenty-one victims this time. Atkinson had caught two batches of forty-one and forty previously. We put them in a bucket, where they froze immediately. The change from +29° (in the water) to −20° outside was too much for them, and in their last gasps their gills swelled out to an enormous extent. These fish were about eight inches long, the same *Notothenia* we had met with before. In shape they resembled "Miller's Thumbs."

Atkinson found some parasitic grubs in some of these fish, and took them over to Dr. Bill. The latter was engaged on some wonderful sunset sketches, but abandoned this task and nonchalantly proceeded to make a lifelike water-colour of pink parasitic grubs on a purple background of liver and gall!

I received a commission from Ye Editor to write the introductory article for the *South Polar Times*. "On Ross Island and the Ice Barrier. What it was like, is like, and what it's going to be like!" I started seriously with petrology and volcanics, etc., and then gave up and went in for romance out of my head. Cherry seemed very satisfied with it, and authorized me to write as much as six pages of print—illustrations to be contributed by Bill!

Captain Scott gave his first lecture on the 8th of May on the "Plans of the Expedition." He had thought out all possible details, and ultimately carried out his plans exactly, so that I do not need to give full notes. He relied on the ponies essentially, and frankly confessed that he was disappointed with the dogs, though he added that this may have been due to their food.

With regard to the motors, he hoped they would help; but he was not using their loads in his calculations. He realized that he was here carrying out an experiment to benefit future expeditions.

He felt it best to adhere to his original plan and proceed as if Amundsen were not in the field.

He said the great difficulty would be on the plateau. "Shackleton was five weeks there, and was nearly done, while the Pole party will have to spend ten weeks on the plateau. If we have bad weather," he added, "no one can stick it. One last point: you will see that this will take 144 days. If we start on November 3rd—and earlier will kill the ponies

—we can't get back till March 27th. Now, no ship can remain in the Sound as late as this, so that inevitably the Pole party must stay another year; and if a small party stays, there might as well be a large party to carry out further explorations."

There was a long discussion on the possibility of getting ponies up the great Beardmore Glacier. It turned largely on the character of the glacier—so Dr. Bill came out with a base suggestion that the physiographer be deputed to read up all the available information, and give a lecture thereon!

Ponting asked if the pony food could not be in part edible by men. He was questioning our cavalry captain, and boldly suggested that oats should be eaten—which *double entendre* amused the House.

Simpson has been wandering around disconsolately getting people to smell a liquid in a bottle. Something is wrong with the petrol engine, and all the engineering talent, including the cook's, is at fault. Finally it was decided that this doubtful liquid from the tank was kerosene, and not petrol, and that perhaps a fresh supply of more suitable diet would remedy matters.

Ponting gave a lantern lecture on Burmah, which was interesting to all of us. However, it had no bearing on Antarctic topics, so that I made no notes thereon.

I had been busy for some time on a series of maps, which I proposed to send in to the editor of the *South Polar Times*. It was evident that among the fifteen officers in the hut there were many travellers, and it occurred to me that we had practically covered the world. So I drew three maps, and in place of the geographical names I inserted the names of the travellers. Finally, I made a table of countries visited, and those who were near the head of this table were quite keen to see who was the greatest traveller—in this limited sense. It was soon evident that the contest lay between Captain Scott, the oldest, and Gran the youngest of the party! The "Owner" called out several times after I'd got his list, "Did you put me down for Peru . . . and Azores, etc.?"

The final results were—

		Chief areas.
Captain Scott,	59 mentions	First in Africa and America.
Gran,	53 ,,	Second in Europe.
Lieutenant Evans,	42 ,,	First in Europe and America.
Meares,	39 ,,	First in Asia.
Taylor,	33 ,,	First in Australasia.
Ponting,	32 ,,	Second in Asia.
Bowers,	31 ,,	Second in Africa.
Garrard,	27 ,,	Second in Australia.

There was then a considerable drop to the remaining seven men. We had about two hours' violent discussion when I read out the list. Simpson objected to the sailormen being placed so high, for obviously in most cases they merely touched at the seaports, and saw little of the country proper. He said he would arrange them as follows: Meares, Taylor, Ponting, Scott, Garrard. At any rate, Simpson could claim the widest polar experience, for he had spent a year within the Arctic circle studying the meteorology of Lapland! Scott, Wilson, and Day had been many months in Antarctica before; but unfortunately this is no-man's land, and I only allotted each of them two marks for all this!

My second night-watch occurred on the 11th. It was blizzing outside at forty miles per hour. Hooper provided me with a fine repast, which I sketched to fill in time! There was cocoa and bread and butter—a sort of currant-pudding (euphoniously termed "Bugs in Bolster"), jam, honey, and milk. No sardines, so that it was evident that I had got on the blind side of the commissariat.

Cherry yells out, "Didn't you get it away from thé cliffs, Sunny Jim!" which indicates that he's dreaming of tracking balloons.

In the wee smaa' hours I wrote "Valhalla, a celestial medley," for the *South Polar Times*. This skit on the manners and customs of the Antarctickers met with undeserved favour in Scott's eyes.

On the 15th Dr. Bill gave his second lecture, of which I took full notes, and give them herewith.

LECTURE ON PENGUINS.

By Dr. Wilson.

May 15, 1911.

There are many varieties of penguins, but they are all restricted to the Southern Hemisphere. Although a number of fossil forms have been found, they are also not known north of the Equator. With the exception of the Galapagos Islands and the southern shores of the continents, they are chiefly found on the sub-antarctic islands.

Fossils occur in South America, where many genera have been identified. For instance, six come from Seymour Island (Graham Land) and five from Patagonia. In New Zealand there are fossil skeletons six feet high, which were first described by Huxley. They occur in Eocene limestones.

The origin of the penguins is obscure. They began to specialize very early in the history of birds, and all relationship to other families is obscured. Probably they could fly once, but now the wing-feathers are not of the type used for flight. The requisite muscles are degenerate and the tendons have become ligamentous. Its feather tracts are distributed like a lizard's scales, and the arrangement is in no way so advanced as in that of a domestic fowl.

The earliest bird, the *Archæopteryx*, had teeth, and one or two modern birds (*e.g.* the goosander) have makeshift teeth to grip slippery fish. One hopes to find real teeth in the embryo of the emperor penguin, though none are present in the adult bird.

Some of these early Cretaceous birds were divers, and so had adopted aquatic habits. Their shankbones were formed of three parallel parts, and this structure is exhibited in the emperor, though in all other birds the shankbone is solid.

Probably New Zealand was the original home of this type of bird. Their nearest allies are the petrels and divers, but the relationship is doubtful.

Groups.—There are three main groups of penguins—

(1) Emperor, King, Pygosceles. — From 53° S. to the edge of the Pack, *i.e.* 78° S.

Adelie. Ringed. Johnny.

(2) Crested Penguins with long golden feathers over each eye.
(*a*) Royal.
(*b*) Great. — From 38° S. to 55° S.

(3) Jackass Penguin. — 50° S. to the Equator.

Breeding.—The Emperor lays one egg and incubates it between the feet and the breast-flap. The Johnny penguin seems to have the same habit. The Adelie scratches a bare hole in gravel. The Crested penguin makes a grass nest, while the Jackass burrows.

Migration.—The Antarctic penguins spend about eight months on shore and four on the pack-ice. They usually remain within fifty miles of land.

The Adelies arrive in Ross Island in mid-October, the scouts preceding the main army by some ten days. After about ten days choosing nests the first egg is laid, and then the second soon after. They are hatched in a month.

Feathers.—The Emperor chick has two sets of down feathers. The earliest is pushed off at the end of the new feather in a few days. And then the final feather forms the base of the down feather.

The Adelie moults at the end of February.

Food.—The Adelie gathers a crop full of shrimps, and then has to run the gauntlet of all the chicks to reach his own nest. You can see his terror that none will be left for his own, for they are meanwhile digesting! The young birds remain on land until starvation drives them to the water. It is inexplicable how they know where to go!

The Emperor lives on fish, and so has a different-shaped beak. They obtain their food by diving down through cracks in the Barrier ice. For one adult hatching an egg there are a dozen unoccupied. And there is such a rush to claim a lonely chicken that the latter simply hates the whole proceeding!

Three-quarters of the chicks have died by the end of October.

From our visit to Cape Crozier in 1911 we know that the young do not shed their down till January. The bay ice is moving out all summer. By January most of it has gone north, and the penguins have gone with it. The chickens are not fit to enter the water in their down-feathers, and after their free ride north they live on the pack-ice for some weeks before commencing to swim.

Penguins swim under water, and breathe with open beaks as they make their frequent "dolphin" leaps.

The dogs and ponies turned up from Hut Point on the 13th—just a month after we left them there. Meares arrived first. He had been lost in the drift, but had wisely coasted along by Turk's Head and got through all right. We welcomed them with their favourite gramophone records. "They all went into the Shop" to cheer Meares, and then "Prehistoric Man" to see how exactly Huntley's voice agreed with Nelson's!

Dr. Atkinson started testing us for scurvy. We submitted our first fingers, and he jabbed them with a pointed glass tube till the blood flowed. I grieve to state my thick

skin or sluggish blood necessitated five pricks. This blood, if healthy, should be quite alkaline, and its alkalinity is tested by neutralizing the blood with dilute sulphuric acid. Anyway, I didn't think much of it! For if most of the fellows were extra good—I was medium only, while Scott and Wright (two of the toughest specimens) were the worst!

Several of the officers were recalcitrant, and refused all the Owner's cajoling to lecture! Oates only gave in after much importunity, for he hated public speaking in any form. However, his lecture on "Horse Training" was awaited with much interest. He solemnly arose and commenced lugubriously with the words, "I have been fortunate in having another date set apart for me for a second lecture," which raised a shout of laughter.

LECTURE ON HORSES.

By Oates.

May 17, 1911.

In feeding the ponies during the winter we must run no risks. The pony's stomach is very small, and he stores water in a cæcum between the guts. In a natural state he grazes 20 hours out of the 24, hence it is advisable to divide up the meals as much as possible and give it them five times a day. This is inconvenient here, but we feed them three times a day.

Compressed chaff made from *young* hay would be very good, but our Australian hay was not likely to be cut very young. ("Oh!" from Debenham.) Bran tends to dry the mouth; oats are good, because he must chew them; and oilcake is very nutritious.

The pony meals are as follows:—

Morning: Chaff.

Noon: Snow, chaff, oilcake, or oats. Always give them water on an empty stomach.

Evening: Snow at 5 p.m.; branmash with boiled oilcake or boiled oats and chaff.

With regard to the famous continental training, our English polo teams can beat the foreigners, as was shown by Colonel de Lisle. It is a Munchausen tale to speak of "lifting" a horse over a fence with the bridle.

Here are two horses, drawn by Uncle Bill for me. One is "balanced," the other not. The better horse puts most weight on the hind legs, which are the propelling members. One should make them walk fast. If necessary, dig them under the ribs! (Birdie plaintively

interjected, "Where is a man to walk to be 'in command of a pony's head and ribs' if he's short in the arm?" And Titus solemnly answered, "Midway.") Cherry's and Birdie's ponies are balanced, but it would take a giant to train "Weary Willie." If you want to back a horse touch him on the front shin. The French school of *haute école* is rather in the nature of trick riding.

In his second lecture (August 10, 1911) Oates discussed pony psychology. Said he, "Consider the thing a horse has in place of a mind. He has no reasoning powers but has a very strong memory. Their vision is not strong, but they do all by hearing. If they hear a shout they connect it with some excitement. To shout 'Woh!' when a horse is backing is both ludicrous and useless—I've done it!

"It might be a good thing to dye the forelock to prevent snow-blindness. As to whether they should be groomed here, I think not. The grease in the coat protects the body. It is best to cut it once and then it will grow thick later. Litter might be an advantage, but they don't lie down much."

Atkinson came in and reported having seen a meteor fall just beyond Erebus. Simpson's precise mind led him to ask, "Did it really fall?" Wherefore Day interjected, "You mean, was it pushed!" Thus do the "pseudo-scientists" hold their own.

On the 18th we played our penultimate game of football. The sun had vanished, but there was a little light at midday. It was, however, so dark that on our return I chaffed Nelson for funking it, and he retorted that he'd been playing just behind me the whole game!

Our routine was now much the same each day. I will quote my diary for May 19.

"A calm morning, but snowing. Wakened by Hooper at 8.15. 'Rouse and shine, Mr. Taylor, sir.' All, however, lie low, except Birdie Bowers, Evans, and Sunny Jim. Then Birdie starts chirruping and keeps it up solid, chiefly directed at the opposite diarists' den. This is inhabited, according to him, by the 'Rubbly Ubdugs.' I go out to breakfast and find penguin feather flavour in the water, tea, and milk. (This is due to a layer of feathers in our glacier supply.) So I make a repast on porridge and marmalade. Nelson and Captain Scott arrive later. I retreat to my bunk and read Edmund Gosse; Debenham starts rock sections; Gran peruses maps to decide where he will go next.

"Our den is invaded by 'Titus' Oates, 'Mother' Meares, 'Birdie' Bowers, 'Sunny' Jim, Bernard Day, and 'Silas'

Wright, from which they are with difficulty ejected, and then I start ye eternal narrative of the Western Journey."

The next lecture was on Ice Problems, by Wright. He showed fifteen slides, including some made from views on our western journey.

We had a long discussion on the flow of glaciers, which lasted till 11 p.m. Discussions were in the air nowadays, and no one had a greater belief in them than Captain Scott. He was quicker to see the weak link in a chain of argument than any man I have ever met. In my own special study of the glacial geology of Antarctica, his practical knowledge quite balanced what I had gained from books or travels among glaciers of the temperate zone, so that I had many talks with him, and owe him much scientifically for his help in criticizing and so strengthening my main conclusions.

Physical measurements took place again on the 21st. There were loud cheers when Atkinson announced my waist as 35 inches. I had "gone steady" on food during the past few weeks and knew this was another libel, and when he corrected his statement I was proud to rank with Dr. Bill with a waist of 29½ inches!

"*May* 25.—It has been blizzing all day, and I will describe the doings in the hut. I am sitting on my bunk in the pose photoed by Ponting, using my little drawing-board as a table. Gran is writing one of his six diaries with Deb's nib, which he blunts. He has a patent plasticene pen rack, which doesn't improve the handle. I told him to learn Russian, or write an Antarctic novel in Norwegian, for he will be at a loose end until ski-ing is possible.

"Debenham is painting his third masterpiece. He uses my plane-table sheet on which to paste down his papers. His little terra-cotta water-pots (shrimp paste!) are much admired. He is rather fed up, because he has just found that he is painting on the wrong side of his drawing. I tell him that won't make any difference! Day also is busy elaborating his sketches. Marie Nelson is writing a voluminous lecture, and making certain of all future arguments by questioning Atkinson, Bill, and Titus (*re* horses, etc.) beforehand. Dr. Atkinson is groping among encysted 'mully-grubs' at his half of the table, while Silas Wright wrestles with pendulum details on the other side.

"Simpson is writing up weather for *S. P. T.*; while, I believe, Dr. Bill has finished the 'hot-stuff' sketches of geology, etc., for my *S. P. T.* article. He has copied most of them from my rough sketches, photos, or specimens. Cherry is flapping away at *S. P. T.* on the typewriter and chortling muchly.

"Teddy Evans is plotting a graticule for the southern survey, while Ponting has just perpetuated the 'Teamsters' in the stable where Titus entertained Meares to tea. Birdie Bowers is writing reams for his lecture on sledge-foods—guess it will make a book! The 'Owner' is reading in his cubicle as usual."

On the 23rd Nelson and I started off for his biological station about a mile to the south on the sea ice. I carried a plane-table, for I wanted to plot the four islands off the Cape. It was a fine clear morning, with tints of yellow, pale grey-blue, and deep blue enriching the sky. Nelson had a special sledge equipped with a winding drum and various boxes of "gadgets," as he called his instruments. With this apparatus he was surveying the depth of the sound, and found that it varied very abruptly from place to place. Next day we went off again, and I obtained further angles from different stations, being unable to find the flag at east base. Finally, I found it beaten flat by the blizzards, the 1½-inch thick standard of solid male bamboo being snapped to splinters.

On Queen's birthday Captain Scott informed me that he was afraid I should be able to do very little science on the southern trip. "You would only be able to go up the Beardmore and down again, so your time would practically be wasted." So that he decided that I should go west to Granite Harbour, at which I was very pleased, though it was rather rough on Debenham, who was to have had charge of a party in that region. Dr. Bill pointed out that Debenham and I were fully occupied with different aspects of geology, so that there was room for both of us, and Scott arranged that I was to take Gran and Forde as the other members of the party.

My report of the western journey was approaching completion, and I devoted some time to making a portfolio out of purely local ingredients. From the rubbish heap I got me a Venesta box, built of tough 3-ply wood. I brought this into the hut, and with much labour pulled off the galvanized

binding strips. Then I cut out suitable portions, leaving thereon the stencil of Beach's jams. I scrubbed them free of strawberry jam, and then worried Day to give me a nice piece of sealskin. This I pared down thin and soaked it in alum over-night. Later I riveted it with bifurcated rivets from Shackleton's hut, and the net result was interesting, if not aesthetic!

"It is really the 'long winter night' now. I should say the real darkness began about the 20th, but you can still see to read outside at midday! I nearly got frostbitten paring that sealskin by candlelight in the outer storeroom. Only I kept my fingers in the candle flame fairly frequently!

Birdie Bowers' lecture on Sledge Foods was very good. He poked fun at the "medical faculty" on every possible occasion. I deplored the inability to speak with authority on sledging rations, for in the west I had permitted our butter to be eaten instead of leaving it in a depôt, as the southern party had done! But the chief event was the appearance of Debenham as an advocate for an official tobacco ration while sledging, and when this was settled by the Owner, a fresh argument on the relative values of tea and cocoa between Birdie and Seaman Evans made more merriment.

Late in May Ponting made some of his most picturesque studies. On one occasion we marched out to the west over the sea ice to photo the icebergs. We carried a lantern, and were thus able to cross the numerous cracks in the sea ice safely. There had been rather high tides lately, and these had surged through the cracks and deposited a mushy layer, which was apparently very salty and did not freeze very hard. We could hear the shish, shish of Debenham's ski, but were unable to see him. Ponting had two huge cameras, and had just set up his apparatus when Captain Scott, Gran, and Bowers arrived. The Arch berg had weathered greatly, and the top of the arch had caved in on the fifth with the noise of an avalanche. The berg was rising out of the water and had tilted up great cakes of sea ice. Ponting wanted a figure in the picture, but one wondered if the berg would choose that moment to overturn! When the flash went off, however, I had moved over too far, and so no scale appeared to give an idea of the gigantic mass of ice.

The last day in May was characterized by a sharp blizzard.

It had been quite calm all the afternoon, and Atkinson went off to catch fish. We caught a whole *one*, and the weather was so warm (only 18° of frost) that he was still moving when we reached the hut! This weather lasted till 5.15 p.m. Then in *two minutes* the wind rose from calm to forty-five miles per hour with snowdrifts like driving rain.

Next day we went out to a new hole cut in the 3-feet ice. There was a forty-mile blizzard, but as there was no drift we got out to the hole easily enough, though as it was drifted over we had to be careful not to fall in. Our huge hopes from the new ground resulted in three fish! We had much more rope to haul in and found it rather hard work. Atkinson was much amused by the old yarn of the Irishman's remark while hauling up his mate: "Hold on, Mike, while I spit on my hands!" This was apropos of my having to stop hauling to warm my nose. Atch's went further, and he had to stay outside the hut until the pringling subsided!

Dr. Bill gave us a fine lecture on sketching, illustrated by numerous samples of his own and by copious allusions to the trials of the budding artists in the hut! He pointed out that one aspirant had done a fine sketch of an iceberg with a splendid reflection showing in *stormy* water. I backed up my unfortunate colleague by showing Bill a portrait I had made of himself, which turned out "handsome" instead of "life-like."

LECTURE ON SKETCHING.

By Dr. Wilson.

May 31, 1911.

Sketching down here is very different from this class of work elsewhere. We are limited in our tools, being confined to pencil and chalks; and even with these we can only finish a sketch on the field in mid-summer.

Accuracy rather than the making of pictures should be our aim in Antarctica, especially as our sketches are largely connected with scientific work. Nothing can be done with colour, though on the 1902 expedition I carried forty coloured crayons and tried to use them out of doors. Nansen, however, managed to do some useful crayon drawings in the Arctic.

My method is to make pencil drawings in as great detail as the

temperature will allow, and to scribble over a sort of artist's shorthand. I use very few colours, and can indicate Prussian blue, for instance, by pr. b., etc. Even in temperate regions you have to use somewhat similar shifts, for you can't sit down to paint a brilliant sunset. This "shorthand" I practised largely in Norway in 1897. One gets into the habit of realizing quickly what colours will mix to give the required shade.

In Antarctica every topic requires a different method of treatment, and all require accuracy. Now here are some tips that you may find useful.

Every line is to be criticised as a part of the whole lot, which means you musn't scribble haphazard. It is a good test if you can discover something in your sketch which you did not realize when you drew it. Always try to analyze the gradations and colours; this power is largely a matter of habit. You can't overdo the exercise of your power of "seeing," and down here the shades are so subtle that you get very good practice.

No coarse methods will reproduce snow, ice, or distant mountains. All these take time, and I notice that surveyors and physiographers fail here!

Now I will try to point out why some sketches fail.

There is a promising art student present who drew an iceberg. He had not attempted one before, and so did it carefully and successfully. But beyond this are waves and sky, and he thinks he knows them. So we find him showing the berg reflected in waves! He should have roughed in bits of the waves and sky and made notes. Here we see the necessity of a first sketch which shows you bits of every feature of the whole.

The pencil is the only thing to use here, though in other regions you would also make a rapid sketch to show colour contrasts. Don't try to draw with a brush.

To reproduce your sketches, you use H and F pencils. It is very difficult to grade snow and sky with ink. It is best to use a hard pencil so that you don't get into a smudging way, but make each line distinct.

Do your outlines in very faint lines so that they will disappear when shaded, and without the use of rubber. If you want a straight line or circle use a rule or a compass. Be careful to get the horizon level or you will spoil the whole sketch. Remember that nature relieves everything by shadow and colour, but not by *lines*.

Principles of Sketching.

You will find Ruskin's book very helpful. One should have them instinctively, as in the case of so many Japanese and all good artists. The rest must acquire them.

1. *Accuracy*, by attention to small details and differences.

2. Methods. Pen and ink is difficult for snow and sky, and soft pencil is easier.

3. Outlines are the edges of shadows.

4. Perspective is not of much use in Antarctica.

5. Use an empty picture frame to gauge size and position.

6. Colours are mostly snow-white or blue-grey, but occasionally even shadows may be orange or the brightest blue.

7. In shading, first practise with a square on white paper and hatch it. Be careful never to go over the edge.

8. To test the inaccuracy of your eye carefully copy a maple leaf and then superpose it on the original.

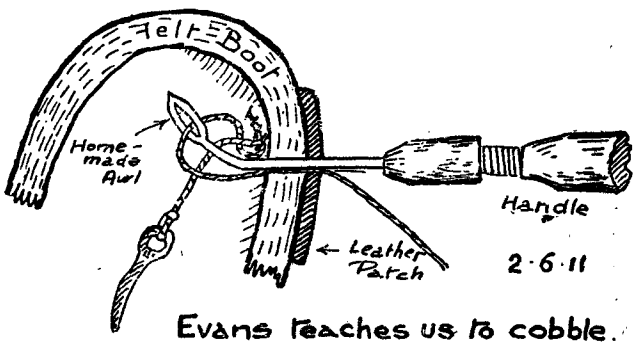
9. If using pen and ink outlines only, never thicken a line. Use even lines, and remember that it is imperfect because there are no outlines in nature.

10. There is no *royal way* to do trees or clouds, etc. Be careful not to adopt mannerisms.

11. Clouds are solids with a light side and a shaded side; and also with perspective.

And he ended up with a sly reference to myself. "In drawing land forms you tend to become a physiographer"!

I spent the next morning on a "make and mend." My Russian felt boots were wearing out from the usual cause: not through rough surfaces, but from scorching when drying near the stove! So I borrowed Wright's sewing awl, and Taff Evans coached me with this weapon. It always used to



Evans teaches us to cobble.

worry me how cobblers sewed a boot when they couldn't see the inside thereof! Anyhow I made a sketch of the method, and afterwards sewed boots, bags, camera cases, and all sorts of gear with complete success.

Procedure.—(A) Push threaded awl through first hole and pull one end of thread out on inside of

boot. To this attach a stiff point, *i.e.* a nail.

(B) Pull back awl and push through next hole.

(C) Make two loops of the awl thread (see sketch) *inside* the boot, and put the nail through the loop, whose end is attached to the boot (the other loop is in the supply thread), and so on.

Then I darned four socks, using string instead of wool, for with *four* pairs on, and with our hardened skin, the roughness was immaterial.

Whit-Sunday came along in due course, and we had Church service. This consisted of the usual Morning Prayer with the special Antarctic Collect and two hymns. Absolutely the chief lack in the hut was a hymnal with tunes! We had a Broadwood piano and a dozen hymn books, but no music except three or four songs, such as "Asleep in the Deep," "Old Madrid," and "Alcala."

Captain Scott asked me to vamp some tunes for the hymns. I could really have risen to hymn *music*, but was unable to vamp, and told him so. I tried to invent an accompaniment or two but failed dismally. Cherry next negotiated it, and managed one or two quite successfully; but each fresh tune needed such a lot of practice that he gave it up after a few Sundays.

However, there seemed no end to the tunes known to Scott and Bowers, and these with Wilson, Debenham, and Lashley formed quite a respectable choir.

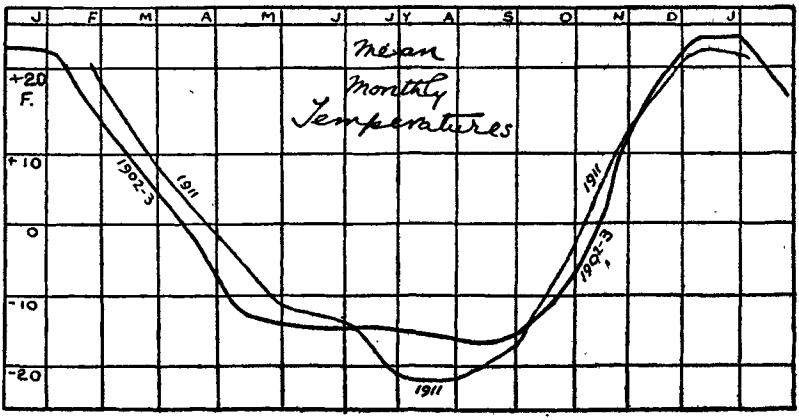
The Owner was very keen on the hymns. On one occasion he gave out "Onward, Christian soldiers," and was so dissatisfied with the result, that he specially repeated the same hymn next Sunday till we were more in unison.

The *South Polar Times* was now finished as far as the letterpress, and was in the hands of the binder. The whole production was supposed to be a secret, but it was necessarily a very open one! We could all see Day manipulating sealskin and Venesta board—in his bunk; though I don't think that any one expected he would make such a really artistic job of it as he did. Ponting printed four of his finest photographs on very large sheets and then moulded them and

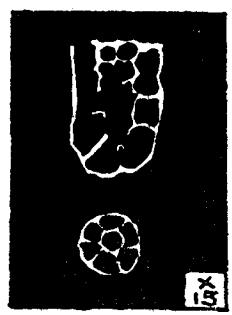
trimmed them as plates, and they added greatly to the beauty of the resulting volume.

I had handed in my official report on the first western journey to Captain Scott, and now busied myself with a comparison of the meteorological results of the 1902 and 1910 expeditions.

The temperature curves are very interesting and are shown in the annexed figure.



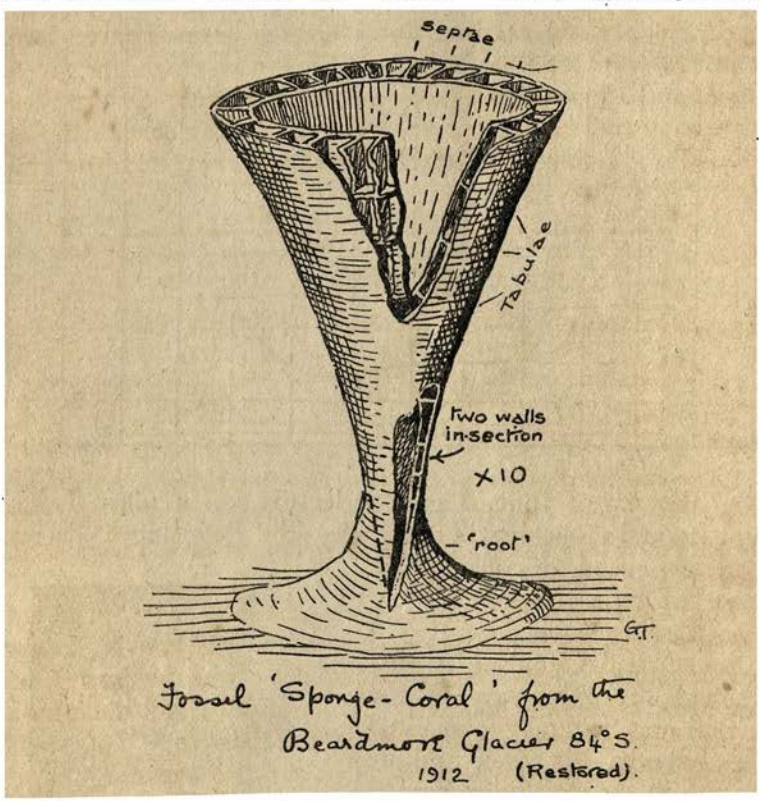
On the 5th of June, I gave a lecture on a place I had never seen and probably will never see—the Beardmore Glacier. I had to spend a considerable amount of time in reading it up in Shackleton's book. Scott had lent his copy to Campbell, so that mine was the only copy in the hut, and was naturally consulted by everybody. It is a unique copy, for all the expedition signed it, so that it forms the last collection of such autographs; and later Sir Ernest was good enough to write a brief letter therein on the opposite page.



Sections of Fossils Beardmore Gl. 1908.

Curiously enough there was one aspect of the Beardmore on which I could speak with some authority. I had spent two years in Cambridge doing

paleontological research on some Cambrian corals from Central Australia. Among the specimens which Shackleton had brought back from the farthest south rock was a small pebble of green marble. In this were some minute fossils, and they turned out to be the same "ancient-cups" (*Archeocyathinæ*) as I had described in Cambridge. So this unique specimen was handed over to me for description, and I was able to tell our fellows the "habits" of the Beardmore corals.



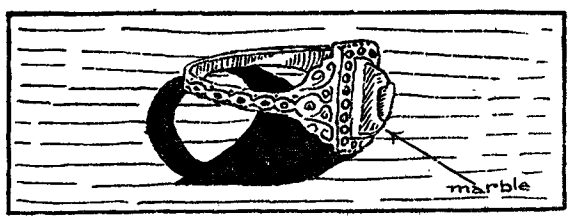
These queer fossils seem to unite the characters of the two great families of sponges and corals. They died out in the Cambrian age, but are of world-wide destribution in deposits of that period.

I had drawn an enlarged map of the Beardmore, and I read extracts from "The Heart of the Antarctic," describing the position of the crevassed areas, etc. My next "old master" was a fine effort—a sort of panorama of what you

would see looking back down the Beardmore. I had commandeered it from the *Sphere*; but it seemed unnecessary to say so!

Then from some notes given me by Professor David, I was able to describe the geology of the rocks fairly fully.

Two contrasted longitudinal sections of the Ferrar and Beardmore glaciers showed the immensity of the latter and its comparatively slight slope. I even had a specimen to exhibit! a small piece of the original fossil-bearing green marble hung as a pendant on my watch-chain. This was examined by all present, and the southern party swore to pick up all the green marble they could carry, on the off-chance of it containing my pet fossils! I may be allowed to mention that this specimen



The most southern fossils: archeocyathinac marble set in a ring.

now adorns a lady's ring, and is mounted after a design which I owe to Lady Scott.

The question of collecting specimens was important, especially as no geologist was going south. However, I asked them to collect fresh pieces (which need not be large), and from rock *in situ* if possible. A description of the physiographic data most required finished the lecture.

Dr. Wilson raised a question as to the meaning of the word "glaciated." "Is Erebus glaciated?" he asked. I said "No, not in the strict sense"—for the word applies to regions laid bare after a glacier has retreated. Scott thereupon said that a new name is needed for glacier-covered lands. (I think the word "glacierized" is permissible for this type of country.)

The Owner and I had a great cag as to the shape of the ice at the mouth of the Ferrar Glacier, which he had explored in 1903. I said in 1911 it had a *tongue* jutting out to the

south-east; he thought there was a *bay* here! "This is very queer," said Scott. "Well, I can't make it out! I expect I shall continue to believe I'm right, and you will believe you're right." I said, "I can do better than that. I believe we are both right, and it's these incomprehensible glaciers that are wrong!"

It was late when I turned in and most of the others were asleep. Some were dreaming, for Cherry cried out suddenly, "But look here, those horses are quite unloosed!"

Titus Oates was awakened in the next bunk and inquired anxiously, "What's that about the horses?"

It will have been gathered that there was some touch of the navy about our life in the Hut. I may, without breach of confidence, say that I had been warned by a former explorer against the "side" of the naval men. This advice seems most amusing on looking back at our experiences. Apart from Scott the naval men were younger than the scientists, and their attitude may be gathered from their nickname—which they bore with considerable complacency—of the "pseudo-scientists"! But it was a case of give and take. A naval man would wish to learn some branch of science, and one of the most amusing evenings was when one naval student underwent an examination by one of the geologists and successfully attained honours, through the whispered promptings of the other geologist.

The account of the lectures will show how catholic were our interests. Practical meteorology and navigation are two subjects in which I received kindly assistance from the respective experts. Dr. Bill, as I have shown, was willing to devote hours to any of us who wished to learn to sketch. Ponting was always ready to train the southern party so that they might obtain a satisfactory photographic record of the Polar dash. And so on right through the community, including the seamen and others in the mess deck. I am sure the latter enjoyed the free life. It must have been a topsy-turvey experience for them to see the weary watchman—who was always one of the officers during 1911—nodding or shivering over the stove, while they snugly slept through the night.

Occasionally, if the unfortunate officer fell over the fire-irons, or otherwise disturbed the "mess deck," the sailor men

would permit themselves the luxury of caustic remarks behind their curtains—well knowing that the chance of scoring off a member of the "afterguard" would not occur in a less socialistic community. I remember playing off a game of bezique with Taff Evans, who rather prided himself on the game. At first, to my amazement, he was beaten, and the mess deck crowded into our cubicle to jibe at Taff! However, he soon got "topsides" of a mere geologist. Dr. Atkinson was keen to learn Russian, and we used to hear him chanting vocabularies with the two Russians in the mess-deck.

If we wanted any repairs done, it was always easy, with a little blarney, to get round Evans, or Crean, or Lashley, or one or other of the petty officers, and all the scientists learnt something of many handicrafts through contact with the stalwarts of the navy.

Debenham and Gran went off to visit Hut Point, and bring back the specimens we had left there in April, so that I had the Ubdug cubicle to myself. The enemy took advantage of my lonely condition, and just as I had got off to sleep a great beam of wood, six feet long, was pushed into my bunk by some base villain. I arose in my wrath, and seeing that "Marie" Nelson seemed somewhat conscious in his bunk, I pushed it on to him, and added a chair or two, and various other movables. He fell upon me, and we rolled about over the main table until I skilfully deposited him up against the Owner's cubicle, when he had to desist for fear of wrecking it. Birdie Bowers, Meares, and Oates were hugely delighted, the more so because Birdie had done the foul deed!

Such were the cowardly tactics of the Bunderlohg. I was too tired to attempt to chastise Birdie, and turned in again, merely remarking that he would not have dared to do this if my honourable colleagues had been present.

It was quite an accident, but almost all the scientists and non-naval men were on the port side of the hut, while the naval men and "Teamsters" were on the starboard side. Dr. Wilson was out of place in the ranks of conservatism; but as he used jovially to egg on both sides, we rarely knew his opinion on the burning questions of the day!

Curiously enough, the right arm of the conservatives ("reactionaries" *we* called them) was our biologist Nelson. He and Bowers argued largely, until Birdie became too deeply

immersed in the question of stores to attend to much else. But I was credited with a nimble tongue, and Simpson was always crushing, with his inside knowledge of social problems, so that the Progressive Party was by no means unrepresented. We could always rally a strong colonial contingent in the persons of Debenham (Australia) and Wright (Canada); and never have I had such amusing arguments (cags we called them) as during the Antarctic night. Woman's Suffrage I have known argued *ad nauseam* from dinner-time (7 p.m.) till midnight, when Nelson and myself were left still opposed, and still full of argument. Prayers for peace never deterred Nelson from preaching women's inferiority. Boots were the arguments that usually drove him to seek his cubicle and sink to rest.

In mid-June there was bright moonlight, so Wright and I decided to visit Cape Royds, and get a few things from Shackleton's hut. I started with balaclava and wind helmet, and two pairs of gloves. As there was no wind, and only −8° temperature, I shed first the helmet, then the balaclava, and then the thick and thin pairs of gloves! It was about six miles only, and of course much easier by the sea ice than *viâ* the crevassed Barne Glacier (our route in January). We got some gas tubing, which Day wanted, some ginger for Atkinson, tracing paper and a chisel for Charles, and I bagged a carpenter's rasp. It reminded me of Crusoe's visits to his old ship, for it was great fun poking about in cupboards, not knowing what treasures might turn up.

We soon turned south to our own hut, meeting Birdie and Cherry also off to Cape Royds. On our left Erebus looked like a great cone of white sugar against the blue-black sky, where the moon shone resplendent. Charles rudely scoffed at my poetic wish that Luna were a mirror and would show us how the world were progressing!

Debenham and Gran returned next day after an absence of six days at the Discovery Hut. On arrival they found one of our dogs (Macaca) lying in the porch. He had been lost for a month, and was naturally pretty thin! They fed him on some biscuits, and then got the blubber stove going. In the whole time they had only had three hours decent weather! In the same time we had only experienced three hours bad weather. But every day was showing us more and more

clearly that the weather conditions were extraordinarily localized in the Ross Island area.

They had started back on Sunday, but were caught in a snowstorm when about two miles off, and so took their bags off the sledge and bolted back for safety! Monday was very thick; and later Debenham woke, and his watch said 2. The only clue as to whether this was 2 a.m. or 2 p.m. was that the dog seemed very hungry, which made them think it was morning. So they rushed off without breakfast, and expected to arrive in time to have it with us; to find us just getting ready for supper! It was a quaint coincidence that Birdie and Cherry had also lost count of time, and came in expecting breakfast at 7 p.m. Such is the pernicious effect of the sun's absence for four months!

For some weeks I had been helping Simpson in the magnetic hut. Each Thursday he secluded himself in the little asbestos hut, and proceeded to obtain absolute measurements of the magnetic field. He had a small stove to warm the hut, and kept the temperature at +65°, so we were comfortable enough, except that a wind of sixty degrees of frost sailed in through the hole in the wall by which he viewed his stadium.

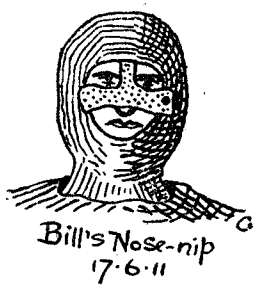
At Cape Evans the magnetic variation was about 150° E., which means that the north-seeking end of the magnet pointed to the south-east! In other words, we were far to the southward of the south magnetic pole. In fact, when we were at Knob Head Mountain, up the Ferrar Glacier, the variation was nearly 180°, and we were close to the line joining the south magnetic pole to the end of the earth's axis—which is the real South Pole.

The procedure in the magnetic work was too technical to be inserted here. However, Simpson estimated the dip of the needle by accurate measurement of the angle of rest of a magnet swung on a horizontal axis. Then he got the horizontal factor. This controls the position of an ordinary magnet, as usually swung on a vertical axis.

The results were used as a check on the continous record obtained from the magnetometers in the ice grotto. At certain fixed dates Simpson and Wright carried out "quick runs." All the chief observatories in the world were doing the same work at the same instant, and Simpson's work, so

near the magnetic "hub of the universe," was obviously of prime importance in this connection.

The Cape Crozier party were now busily engaged with their preparations for the midwinter journey to the haunt of the Emperor penguins. For some weeks Cherry had been practising hut-building near Skua Lake. He used the kenyte boulders, which lay scattered around the hut. It was roofed with sealskin, and in one corner he managed to maintain a blubber stove.



Uncle Bill was busy making a patent nose-guard to withstand the blizzards of the Barrier.

"Extraordinary the affection a fellow gets for a pair of old pants!" says Birdie, who has spent all morning darning a pair for the midwinter journey. Dr. Bill glances at them, and says drily, "Most extraordinary!"

Some one else chimed in, "It's queer the way your clothes vanish in this hut, even if they are *marked!*" We all agreed that the only safe way was to wear them. Gran pathetically remarked, "And dey do seem to go den too!"

Said Meares caustically, "Never mind, you'll find them when you have your next bath" (which sounds unkind, if you don't understand the difficulties of bathing in the hut; for Gran melted down bits of glacier for a wash as often as most of us!).

I went out to South Bay to see how Nelson's biological station was progressing, and carried a thermos flask with me. The moon gave a little light. His semicircular wall (called the "Igloo"; quite wrongly) was built of mush ice from the hole, and was now six feet high, opening to the north. It was curious how the blizzard drifts rebounded from the wall and left a windward trench all round the latter, though a great pile of drift extended many yards north (to leeward).

He picked at the new ice with a crowbar and ladled it out with a sort of net. Then he pulled up his nets, which phosphoresced beautifully from transparent *Siphonophora*. It must be understood that though our air temperature in winter was below $-30°$; yet the salt water was always $+29°$ (or 59° warmer!). So that a sound scheme would have been to have

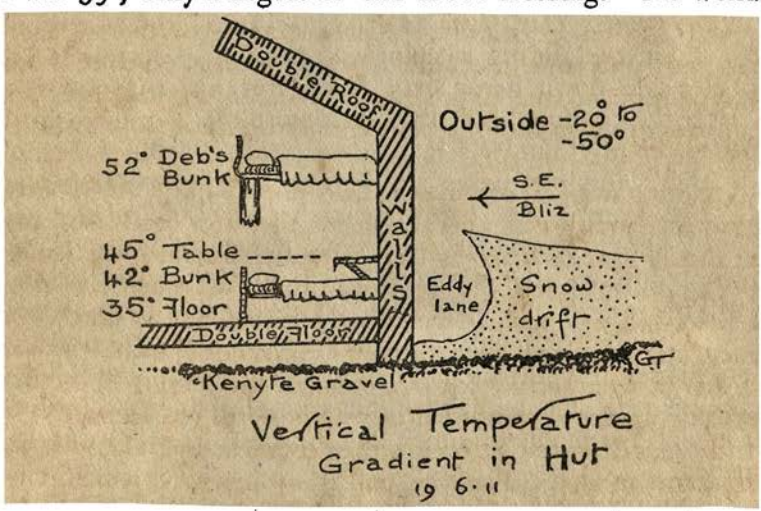
had a diving-bell retreat and go down under the sea ice, out of the blizzards at minus thirty. This was, of course, just what the seals did !

He emptied the animals into the thermos flasks (which were intended for *our* comfort), and so got them back to the hut without their being damaged by freezing.

Then we returned to the hut, facing the keen north wind ; so that a characteristic photograph of *any* explorer under such conditions is shown in the annexed sketch !

Debenham and I had some arguments as to the temperatures in the hut. I felt cold in my bunk, whereas he said he was always warm in his. However, we got a thermometer and tested the temperature at various levels.

Near the stove it was 55°, but on the floor in our cubicle it was 35°, only a degree or two above freezing. No wonder



our toes got cold. My bunk was 42°, the table was 45°, and his bunk (six feet above the floor) was 52°. So that naturally he was warmer in the belt of ascending air. However, the

elevated bunks were (like the "gods" at a theatre) not specially well ventilated, so that I preferred my cooler sleeping-place.

Next day Simpson and I went off again to look at the Igloo. There was only a faint starlight, and we could neither find the Igloo nor the Cape when we turned back! However, we steered by a star and got back to the hut by a longer route, during which I fell three feet into the tide crack between the sea ice and the hut.

That evening Day lectured on "Motor Sledges." It was good to hear him so optimistic. Scott told us of his experiences at Lauteret in France with the "Antarcticker" Charcot. (Quite recently a statue to Captain Scott has been erected by the French in this region.)

I had agreed to sketch the movements of the steam cloud from Erebus during the winter, but I note on the 20th June, that it was about the first time for a month that I had been able to see the top of Erebus. Ponting reported that it was glowing strongly during the day; but no colour was visible when I went out to look at it, while Debenham spent a long while outside on the off chance of an eruption. But $-35°$ cooled him off, and he came in unsuccessful.

"*Midwinter Day, June 22*, 1911.—Here it is Midwinter Day, and except in my sleeping-bag sledging, I have not felt specially cold down here, sixty below freezing without wind is perfectly comfortable. But this morning a nippy north wind made my thumbs ache while cutting out the fish trap, and Atch's and my noses are getting red-tipped and sore. Still, I've known that happen elsewhere! One never gets 'chaps' here; I wonder why? However, August is the coldest month and the stormiest, but it will be lighter then.

"This afternoon, at 3 p.m. (Greenwich) there was a strong twilight to north. Light red (a clear non-yellow colour) along the horizon. Then indigo—probably a cloud—then clear pale blue, and above this slate-blue merging into the star area. No moon or sun. But an hour later all this had vanished.

"I am on night duty. Dr. Bill was up till 1 a.m. He heard me cursing because I couldn't find my towel after my usual bath, and came to help me. Bathing at 6° above freezing-point, you don't care to wait about much! I have

on my Jaeger coat, felt boots, two pairs of wool socks, wool helmet, two jerseys, thin flannel shirt, and thick singlet, thick underpants and thick corduroy trousers. By keeping my feet up on a chair out of the cold 'floor air' I keep comfortably warm, but will probably go into the kitchen galley.

"2.30 a.m. Just been putting in half an hour with the confounded stove. I added compressed fuel at midnight, but later found it nearly out. I've devoted one of my two weekly candles to it, but it only flamed weakly. So I waked Clissold. He says it's due to the cold ice I've just put in; but adds, 'Let her rip!' So I don't care. The porridge won't be properly cooked, but most of them like it so!

"I suppose the gramophone will be celebrating to-day. They are fine records. I like the opening chorus to the 'Dollar Princess' best, though I can only hear the words 'across the water,' but the minor key is O.K. Margaret Cooper's ''Tis folly to run away from love' is the only clear girl's voice. Robey on 'Golf' and 'Prehistoric Man' are very popular. Oates always calls for 'The Sergeant of the Line' and 'Why should I marry at all?' Both are good bass songs. The Anona-Banjo dance is fine. Meares likes 'We all walked into the Shop,' while Gran prefers a Creole wail, 'Ma Honey' and 'Madam Butterfly,' which I can't stick! We have a few hymns, and the 'Night Hymn at Sea' is grand.

"Debenham, Ponting, and Cherry (especially the latter) are good at the pianola. It works usually from 5 to 6 and 12.30 to 1.30, while the gramophone runs from 8 to 9 if there's no lecture. We don't have any sing-songs, and they are really not needed with the three or four hundred tunes on the two instruments.

"I snoozed peacefully after my night watch till noon on the 22nd. Then we had lunch, and Cherry produced the first number of the *South Polar Times* and handed it to Captain Scott.

"He had typed all the prose, and (cutting out alternate pages from a day-book) had pasted the sheets in the book between clean pages. There were fifty pages of typescript. Then Day had bound it splendidly in Venesta board. It was edged with sealskin, and he had cut a cameo monogram, *S.P.T.*, through the outer layer of venesta into the dark *middle* layer of the three-ply boards.

"There were about ten full-page illustrations, and many drawn by Bill in spaces left in the text when typed.

"The guessing at authors was very funny. Gran was rabidly curious. I fear no one thought I had done 'Valhalla,' which is a mixed pleasure—for all seem to enjoy it; while Nelson put down the 'Protoplasmic Cycle' to Debenham, though he had actually read the verse in the Pack in my diary! Bill's illustrations are tiptop, especially the three Egyptian tablets. The latter are frightfully clever apart from the draughtsmanship. Every line is a history in itself.

"The *first* sketch shows three of the debris cones on the Ramp. One is labelled—in honour of our cubicle—the Ubdugs, while Birdie, in his green hat, crowns another.

"The *second* shows Keohane painting (he did the yellow funnel on the ship). He stands on Forde. 'Chippy' carries the hut, and Abbott (with frosted hair) helps him. Day on his motor has his long legs and arms disposed in true hieroglyphic attitudes. Meteorological signs for thunder and lightning surround the engine.

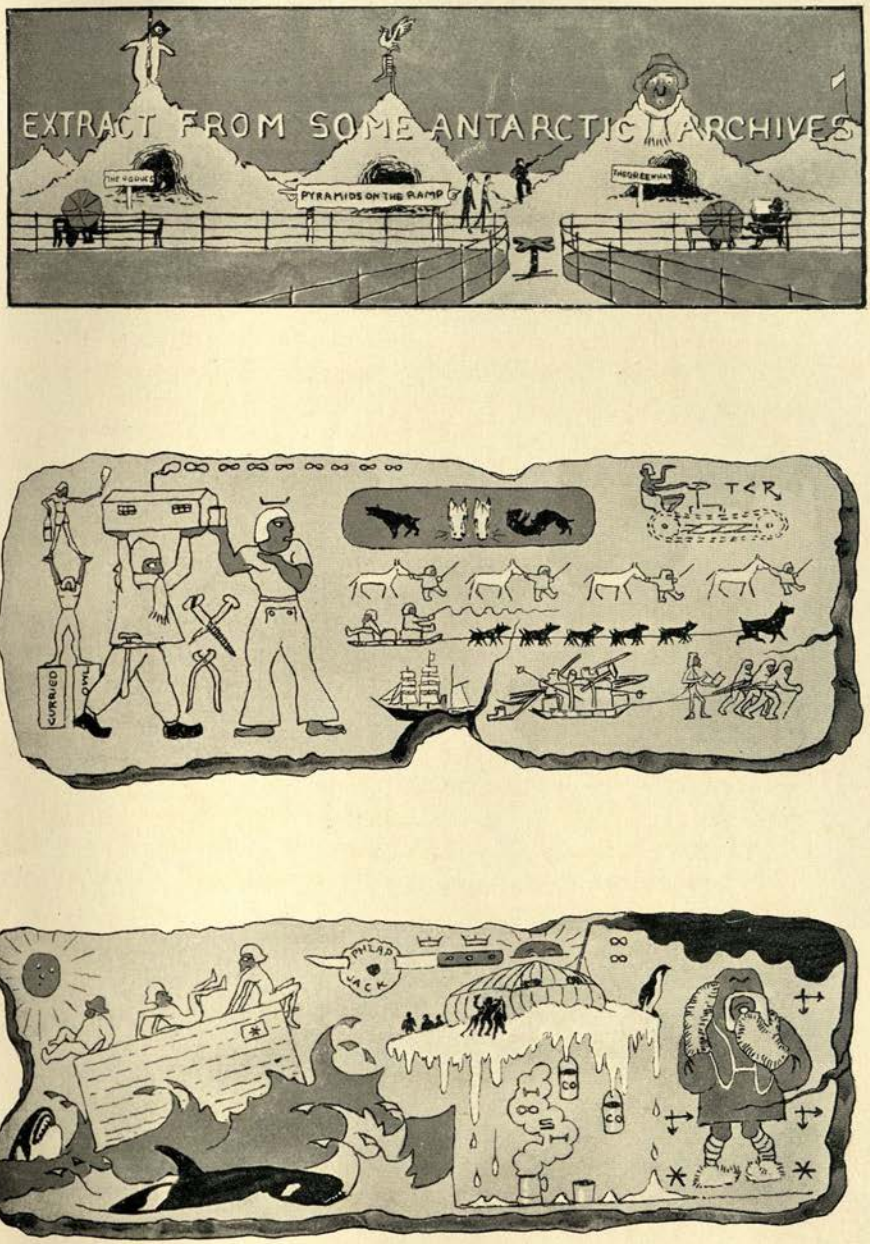
"In the bottom corner is the western party sledging. Three men pulling hard, while one lanky individual provided with a long beard is sketching instead of working! This is a foul and funny libel on myself!

"The *third* represents Birdie, Crean, and Cherry (with spectacles) adrift on the floe. This is labelled with the sign * (for ice) to prevent any mistake. The killer whales are going for Birdie's fat legs. Then there's the 1902 Hut bulging out with ice, with drip-pots to catch the thaw, and 'Hoosh' labelled in Beaufort scale letters.

"In the other corner a screaming drawing of the 'Little Perisher' (Atkinson) caressing a frostbitten ear and nose which is labelled with the 'glazed frost' sign. They are the funniest pictures I have ever seen, and beat Hogarth into a cocked hat for detail.

EXTRACT FROM SOME ANTARCTIC ARCHIVES.

1. And it came to pass that in the month of January,
2. Scothe-Ohnah took up wintak-watahs on Ros-is-land.
3. And there was great barkinofdogs and neighinofhorses
4. With phufphuf of motahs.
5. The Hut was raised by chypechap, fordandkohane.



"SOME ANTARCTIC ARCHIVES."

6. Abbottelped.
7. All said "Itwa s'dam cold".
8. After Three Weeks (E'Linag Lyn) it was done.
9. Then twelve under Scothe-Ohnah started South,
10. Fourundah Sharn-Gatch for the West.
11. Theship departed.
12. The Cobbos parted, Kreen-an-Ephans.
13. Birdibow-Ahs of the mighticaluph reached the furthest.
14. Withim Soljah-an-gran.
15. Bur-de-Cherry and Crean "chaunst their arm".
16. Olswell.
17. Allah-ad-diris.
18. Sharn-ledwel and kambaque.
19. Theoldh-utwas full. Itliqued. Itwa-so-dakh.
20. Soljah-fash-son-ed a stove.
21. It burned with blubber and did nearly all the cooking.
22. Hu Ra. Hoosh. Hush. Hoosh.
23. Thesephroze.
24. Scothe-Ohnah and with him eight others left for Kapevans. Thalef thejonah.
25. Theice bluout.
26. Phrostbit nosears and phace.
27. Thisis thethir tieth.
28. Garnfroste phace!
29. Daian Marie came sledging.
30. They got phrostbit. Algot phrostbit.
31. Bill Esau sumemp-Rahs.
32. Enuphsasgudas-a-phest.

"Gran is very funny about Valhalla! He has been sounding Birdie and Ponting as to the home of the northern gods! Marie Nelson had never heard of Valhalla, but was going to work to find out who coined the word 'pont.' The Owner read the greater part to us. He can make a good speech and write well, but he's no reader, as he confessed! Ponting's plates are splendid. Gran thinks he did the 'Sleeping Bag Medley'; but I doubt it strongly. However, probably my guesses are as wild as any one's and the whole thing is very good fun.

After lunch I went out for a stroll to see the Antarctic in darkest night. No one else seemed keen. I walked to South Bay over Island Lake and back over Skua Lake.

"There was a twilight, grey-blue to the north—an arc extending from about Granite Harbour to Cape Royds, and this gave some light. I wore my felt boots, which are warm

though slippery. I came one cropper through not seeing a drop of two feet down a snow ridge. As I walked up the next snow slope, it gave out an octave—the notes descending the scale! I could just see Tent Island, but could not make out the edge of the cliff close by. It was so calm that I walked part way back without a helmet. I came another cropper, hurting my shin and elbow and so to the hut.

"On my return, I found them draping the hut with sledge flags. My 'blood-stained banner' and Debenham's (both made by my sister) were hung over the table. Atkinson and Birdie made their own flags. (Atch has a black tree on a white silk flag.) Ponting and Oates have none.

"Then we had dinner, while Ponting manœuvred the cameras to get a photo. He moved away all nearer than I was, so I was left in the foreground, and unfortunately practically spoilt the picture! For I meekly cast my eyes down as the flash went off, and am obviously blind drunk! They don't know that I only had a quarter-glass of awful lime-juice, while the others had champagne!

"Then speeches began. The Owner made a ripping speech, pointing out that we'd done half the time, and must realize that we could only do about as much more. Dr. Simpson wished health to the southern party, and we who were going west drank it with him. I arose with an apology for saying, 'Captain Scott, Gentlemen, and NON-scientists.' This dig at Oates, Birdie, and Co. brought down the house, for they have occasionally opened by saying, 'Captain Scott, Scientists, and Gentlemen.' Atkinson and Wright failed lamentably, except that Charles said (*à la* the discussions), 'I have no remarks to make, sir, in addition to those stated,' while Atch said, 'I endorse that.' Debenham discussed the colonial representation on the expedition. Cherry reminded us of the home folks drinking our healths.

"Birdie had moved off to the foot of the table, and said he couldn't make a funny speech, so he was going to *show* us something funny. Therewith entered four of the seamen with a unique Christmas tree.

"It was built of a ski-stick draped with bunting, with penguin-feather foliage, hung over with candles and candied fruit. The gifts were from Mrs. Wilson's sister, and were perfect. Birdie's distribution was magnificent.

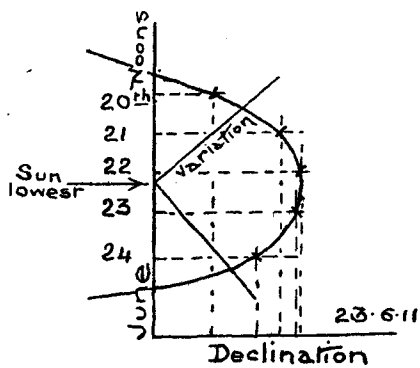
"Every second present or so was a necklace or earrings for 'Miss Jessie' Debenham. Meares got many wedding-rings in memory of his refrain, 'Ting! Ting! You buy the ring.' 'Marie' Nelson had a huge fan, while Dr. Bill got a book of drawing copies. Titus got a popgun, and 'Silas' Wright an envelope marked 'In memory of my native land,' containing the Stars and Stripes! This, as a loyal Canadian, he threw away with contumely.

"I got a 'Physiographic outfit' of shovel, axe, and pick for 'our Griff,' and a packet of shaving paper for 'the Lord High Physiographer,' and (I blush to state) a trumpet with a note which I scorn to set down!

"Then the table was cleared away, after we had pulled crackers, and we sat down to look at Ponting's slides of events to date. They were admirable, especially the Icefoot and Pancake ice. I was exhibited rather frequently, and the incipient beard excited much hilarity."

A few of the seamen became rather merry by this time, and a set of lancers was not a great success, my partner finding the floor unsteady. We all turned in before 2 a.m. (except Dr. Bill, who was on watch), and so ended our Midwinter Feast.

On the next day I spent some hours trying to find the exact time when the sun *was lowest.* As we had not seen him for two months, this may seem difficult! But from the Nautical Almanac it was possible to plot the sun's position (declination) for three or four days each side of the 22nd. This came out a parabola, of which we could not find the exact apex (or date of lowest sun). However, by adding the curve of the *variation* (as suggested by Wright), the date came out readily enough at the intersection of two straight lines.



How we found Midwinter.

"The result at Greenwich was $\frac{1}{10}$ of 24 hours after the noon of June 22 = 2h. 24m. p.m. Our clock* keeps Greenwich time (though we are not quite on 180° meridian), so that this time by our clock was the critical instant of midwinter. Hence Dr. Bill was the only one awake at that interesting moment!

"However, Thursday's dinner on the 22nd was the nearest to the exact time of lowest sun, so we were *en règle*. Meares insisted that I was thus particular because I wanted another feed on the 23rd! This to me, who ate nothing and drank less!"

Gran and I had a competition, as to who could guess the most authors in the current volume of *S. P. T.*, the loser to give a dinner on our return. I stipulated "no alcohol," but, on Gran's remonstrances, agreed to "Australian wines." I thought I should win, for he hadn't contributed, and I knew three of the thirteen with some certainty! I wrote out a list, and so did he, and we asked Cherry to referee. He was not to be drawn from the silence of the editorial chair. Finally he said our bet was off, because we were equal. Teddy Evans, however, declared that he knew most of them, as they'd been discussed by Bill and Cherry in his cubicle. He said I got ten right and Gran nine. At any rate, the first suitable place for a dinner was my own town (Sydney), where, of course, I was host, so that Gran came off best ultimately.

Late in June I gave a lecture on the "Physiography of the Western Mountains." Ponting kindly made two dozen slides for me, and he put these through the lantern, with the addition of some maps I drew on glass, and one extra (by Gran), which was a libel on the physiographer! The problems discussed in this lecture have already been described in my sledge narrative.

On the 27th June the gallant midwinter expedition started. Dr. Wilson was in charge, and was accompanied by Bowers and Cherry-Garrard. Their object was to visit the Cape

* Our local time (which we did not use), corresponding to our longitude 166° E., was 11 hours 5 minutes 46 seconds before Greenwich. Hence it was midwinter at 1.30 on Friday morning of the 23rd by *local* time. This experience of ours was a very practical trial of the Daylight Saving Bill. We used to feel very virtuous when we turned out at 7.30 by our chronometer while sledging, as we realized that it was really 6.30 a.m.

Crozier Rookery, and to study the habits of the Emperor penguins during the nesting season. No one had ever seen them nesting, nor had any eggs, except long-abandoned specimens, ever been found. Wilson hoped to get embryo chicks, and thus study the early stages of these birds, which in some ways are the most primitive existing, and which therefore exhibit features linking them to the reptiles.

They took two sledges, pulling a heavy load of 253·3 lbs. per man. Numerous bamboos, specimen bottles, penguin-nets, special clothing, etc., accounted for the load; but they proposed to be absent five weeks and would need extra provisions in view of the extremely low temperatures. No such trip had ever been made before. No one realized what they would have to encounter, and I hope no one will ever again attempt to do anything so close to the confines of human endurance.

Nelson, Gran, and I accompanied them nearly to Glacier Tongue. We could just make out the black crags against the white snow. I had a bet with Bill that we could see Little Razorback Isle. I lost, for it was the 500-foot cliff of Turk's Head, and this was a pity. I was so sure, that I bet him the small amount of £40,000,000!

"When we stopped I called for three cheers for the Cheery Winter Knight, the Short Winter Knight, and the Long Winter Knight. When they saw that I meant 'Knight' (and not the surrounding gloom!) they laughed muchly, and we left them cheery."

In the evenings we went in for games of various sorts—though never *cards*, for some unknown reason. Captain Scott and Atkinson used to play a couple of games of chess each evening. Nelson was our "star performer" at any game of skill, and could beat any of the others at chess. I should think Debenham and I probably played most chess. Wright and Simpson occasionally indulged, and were of about the same class. Oates and Debenham were fond of backgammon. Evans, Gran, and I played Matador a great deal, until I found myself getting beaten with monotonous regularity, when I decided that dominoes wasn't an intellectual game, and stuck to chess!

"We have just been discussing Jules Verne on the shooting of bears with mercury bullets! The temperature is now

– 40° F. (seventy degrees of frost), and the feat would be possible, at any rate, as far as loading went!"

Outside "Silas" Wright is busy getting "time" from star occultations with a patent telescope. His station is near the rubbish-heap, and is connected by telephone to the hut. It is a cold game, as may be imagined, and to manœuvre in light gloves with delicate screws would try the patience of a saint. I never heard of a Saint Silas, and when Wright's light blows out, the gentleman inside the hut (with the chronometers) blushes at the language carried by the telephone wire. There was a yarn (which it is not necessary to believe) that the said wire had to be drenched with water at regular intervals to prevent the heated remarks from fusing it!

Wright had one of Colonel Sterneck's gravity pendulum equipments, and for this he needed to know times to 0·000001 part of a second! Thus he could tell whether his pendulums swung quicker or slower in Antarctica than in New Zealand. If they swung quicker, then they were nearer the centre of the earth "down south." Thus the good old simile in which the shape of the earth is compared to a flat-ended orange is deduced scientifically by a frostbitten scientist at "seventy below freezing"!

As soon as Simpson had equipped his main station he fitted up a thermometer screen above the Ramp on the icy slopes of Erebus. Later two more were placed on the sea ice—one towards Tent Island and the other in North Bay. These were labelled A, B, and C at first, but these seemed prosaic names when one had literally a chance of losing one's life when one paid them a visit during disturbed weather in the long winter night. So that the screen in North Bay was dignified into "*Archibald*," "*Bertram*" lived above the Ramp, and "*Clarence*" was "way out in the country" to the south.

Ponting and I introduced ourselves to Bertram on the last day in June. He lived beyond the rough moraines, so we had to put on leather boots. One of the dogs (Tsigane) accompanied us. We could just see, and managed to climb up the 150-foot Ramp, with some diminution of wind, and in half an hour had reached Bertram, 250 feet up.

There were two thermometers—one registering maximum temperatures, one giving present reading and also (the most interesting reading) the minimum temperature. On this

occasion the coloured alcohol showed −20° F., −27° F., and −37° F., respectively. In calm weather it was usually from five to ten degrees colder at the Hut than at Bertram, for the cold air sank to sea-level. But in rough weather all the air was churned up, and the temperatures were much the same at all four stations.

We read the thermometers by a candle, for it was a calm day; but my toes began to go, and so we hurried back to the Hut, when I decided to go in for more socks.

After this I read Bertram fairly regularly when the weather seemed promising. Scott definitely ordered that no one should visit the screens if there seemed risk involved, for the Hut thermometer recorded continuously and the others were only for comparison, and got less important as we noted the regularity of their characteristic differences. After a few visits I used to glissade down the icy Ramp, though I could never see when I had reached the bottom, for in the dark you cannot distinguish a vertical from a horizontal plane of ice.

"We had service on the 2nd of July. With our three chief songsters Crozierwards, there is less harmony. I followed Day in the hymns, and he afterwards confessed that he had forgotten the tune; so my help was not valuable! Meantime Simpson had a duet in the corner with Wright. 'Twenty-one, twenty-two, twenty-three' . . . etc.; he counted the seconds through the 'phone to Wright, who was cussing the stars outside. The only accompaniment we had now that Cherry was away was the telephone bell.

"The combination would have been ludicrous if it hadn't been necessary, for Wright had to abide by the transits of the stars, and they occurred service or no service."

The most noteworthy feature in the Hut was a strong propensity to argument. I think Nelson and myself were the chief offenders, as we disagreed on every topic under the sun, and let each other (and also the rest of the Hut) know the reasons! I remember one cag resulted from a night-watch supper. About this time I used to watch from 8 p.m. till 2 a.m., and "Marie" Nelson from 2 till 8 a.m. We went shares in the supper.

Here follows a verbatim report of an argument whose only merit is its accuracy and representativeness.

Scene: Breakfast in the Hut, July 3, 1911.

G. T. (grabbing a fragment). "This isn't your bread, Teddy?"

Teddy Evans. "Yes, it is."

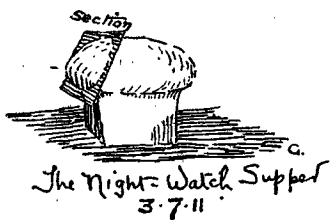
G. T. "Chuck over a bit in your lily-white fingers, Marie!"

Marie. "Now *that's* what I call a well-cut piece of bread. It's symmetrical about its axis."

G. T. "Why don't you call it by its crystallographic name? It's an *enantiomorph!*"

Marie (mentally broken up, but stubborn!). "You're taking refuge as usual in long, meaningless words; anyhow, that's a rotten word; *ante* is Latin and *morph* is Greek. You don't know *how* to cut bread." (Then he proceeded to explain how I maltreated the loaf of our combined night-watch supper.)

G. T. "I know no one else is interested, but I don't see why *I* shouldn't bore them also! (Loud cheers.) That bread crust projected six inches, and I only ate the overlap. You've had all your own suppers, and mine too, all the winter, you miserable, cynical reactionary. Anyhow, *enantiomorph* is *all* Greek, and means 'mirror-reflection.' So it just suits the case."

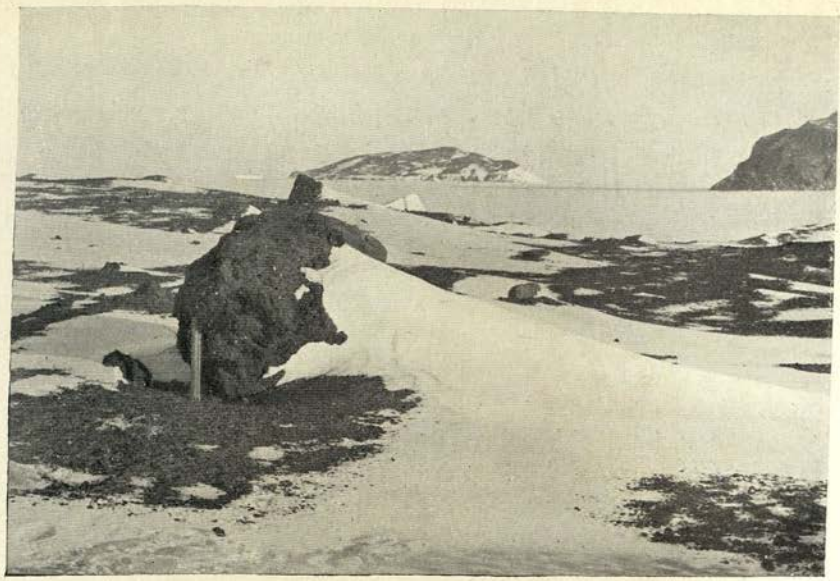


(Marie subsides, the Owner pushes off to his cubicle, and I proceed to tease Ponting. Then the cag is continued in my bunk by Marie *solus*, until I cry *pax*.)

And that's how the long winter night passes!

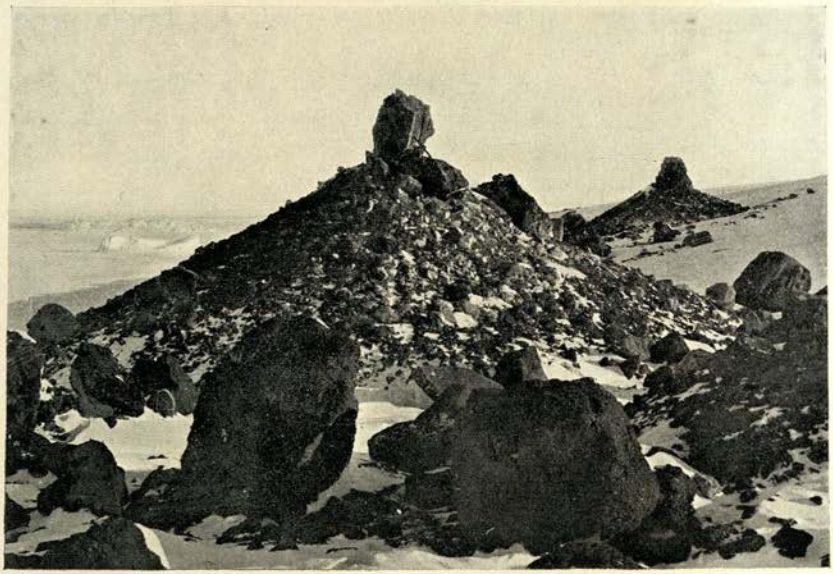
"*July* 4.—Have just been ragging 'Silas' Wright as an American (?) on this auspicious day. Whereupon he fell upon me and succeeded in tearing my pocket. It is a snorting day. Wind fifty miles per hour and temperature —29° F. I went out for a few minutes with bare hands, and it took me about five minutes in the Hut to get them right. Yet it is warmer than yesterday, when bare hands were possible. The wind does it."

We finished the day with the most exciting experience of the winter. Life in the Hut, as will have been gathered, was comfortable enough, and with such splendid mates, I felt it so



SNOWDRIFT ON CAPE EVANS SHOWING THE DEEP EDDY ON THE WINDWARD SIDE, SEPT. 9, 1911.

The drifts all lie on the south sides of the kenyte boulders. Four miles to the south appears Tent Island.



DEBRIS CONES ON LAND'S END (ONE MILE SOUTH OF THE HUT), SEPT. 9, 1911.

Each is 30 feet high and due to the weathering of a huge boulder of kenyte. In these two specimens the process is only half complete, the core of the erratic boulder still remaining. Erebus Glacier on right. [See p. 291.

pleasant that I had to keep on reminding myself that I was in Antarctica in the middle of the long night. Yet occasionally, as on this day, Nature warned us that she was not to be trifled with.

Atkinson and I went off to read Bertram, leaving about 4 p.m. There was quite a lot of drift, and we soon lost sight of the Hut, but luckily there was no mistaking the Ramp. The end of my nose was nipped with −25° F. and the gale of wind. (You can apparently feel something "go with a ping," just as if the blood froze in the end of your nose.) Anyhow, it soon got warm again when covered by my mit. It was worse on top, and we soon lost sight of all rocks and cones. The wind kept fairly steady and we steered by that. After about half an hour I counselled return, and we turned back to regain our bearings, and after being out an hour and a half we found Bertram. The fusees which we carried just burned long enough to read the temperatures (minimum, −38°, maximum, −25°).

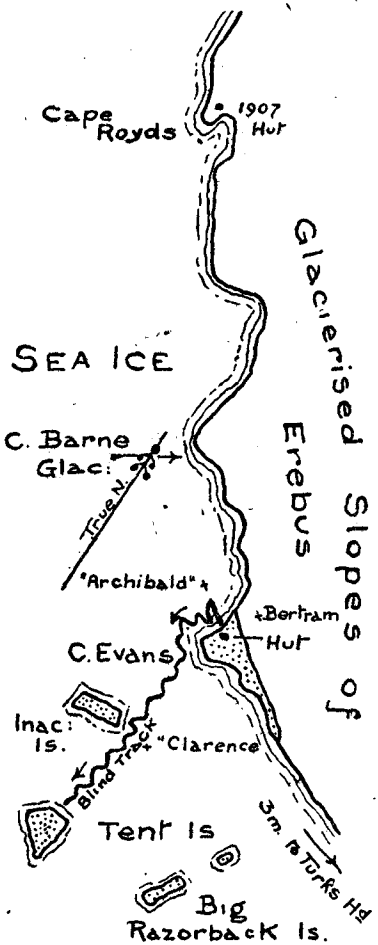
We reached the Hut about 6 p.m., and my task was over. Atkinson was so pleased with our success that he decided to go off 800 yards to Archibald. I tried to dissuade him, but he said he'd be back in twenty minutes, and would just return *against the blizzard*, and so couldn't miss the Hut—or at any rate Cape Evans, which extended a quarter of a mile each side of the Hut.

Gran also started to go to "Clarence" about the same time, but realized it was impossible, and managed to find Cape Evans again, though quite at the wrong place.

About 7 p.m. Nelson and I went out to have a look round for Atkinson. It was very thick but not blowing so hard. We informed Scott of his absence, and he immediately organized search parties, realizing better than we could the seriousness of the event. Atkinson had been out an hour, and we could not imagine what had happened. Day took up tins of oil to the top of Cape Evans, and burnt great flares every few minutes for hours. Debenham, Gran, and I walked along the top of the low cliffs on the Cape with candle lamps.

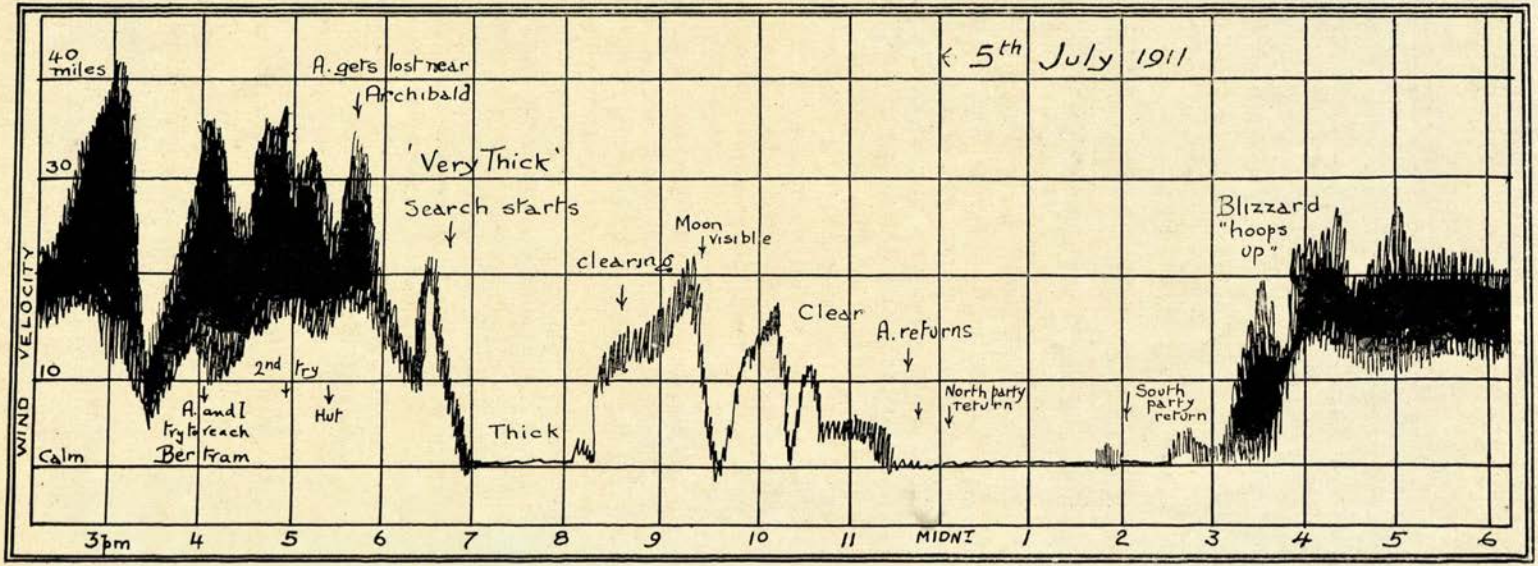
We felt sure that he must have got to the coast, for it stretches for thirty miles along the east, and that he was perhaps sheltering in some cranny. We formed a long chain from Cape Evans to Inaccessible Isle, and it was only by

marking an arrow in the snow that I could remember which way safety lay. For the wind had died down, but the thick drift and the benumbing cold made us more and more anxious as no news came in. From 8.30 till 10 p.m. the blizzard was blowing again, and we began to feel hopeless. Captain Scott arranged for two sledge parties: one, under Lieutenant Evans, went south along the Glacier cliffs for six miles; the other, with Seaman Evans, went north to Shackleton's Hut. They carried tents and sleeping bags. Wright went round the cliffs of Inaccessible Island. Ponting and I searched the Cape Barne glacier. We thought he must have fallen into a tide-crack or sprained his ankle, for now the moon began to show a bit, and at 11 p.m. it was clearing somewhat. We could see Day's huge flares on the cape from a distance of several miles. Just as we reached the big cliff of Barne Glacier two rockets went up, and we knew that he was found. We learned that Atkinson was quite dazed, though he had got back entirely unassisted, and had not seen any one until he reached the Cape Evans cliffs and saw Debenham above him. His right hand was badly frostbitten, with huge blisters on each finger —just like a condor's crest.



Lost in the blizzard, July 4, 1911.

He had walked off towards Archibald with the blizzard, but halfway there turned back, feeling it foolish to persist.



"BLIZZOMETER RECORD" DURING THE SEARCH FOR ATKINSON, JULY 4, 1911.

He got back quite safely to the tide gauge, which was only a stone's throw from the hut. Then he was completely lost. The wind had dropped somewhat. He tried to keep it full in his face; and, perhaps, owing to eddies around the cape, he must have wandered due west away from the hut and towards the open sea. After some hours of helpless wandering, where he had to keep moving to prevent his freezing to death, he came to some high cliffs. He thought these might be the walls of Inaccessible Island, but there is little doubt that he had wandered south now, and was skirting Tent Island. He tried to burrow into the snow-drifts here, and so got his hand badly frostbitten. Then the moon showed faintly, and he owed his life to the fact that he remembered to have seen the moon over Erebus (and therefore east) on the preceding night. So he staggered towards the moon, and after about an hour and a half he reached Cape Evans, and was safe. We had imagined that the blizzard, constantly blowing from the south, would have enabled him to steer east to the coast; but, owing to lulls and to eddies, and finally to his dazed condition, he lost all sense of direction, and would have undoubtedly perished but for the moon. The search parties got in by 2 a.m., and then the blizzard fury increased nearly to gale strength, and continued all next day. It was only during the six hours while Atkinson was lost that it lulled sufficiently to permit of any one venturing away from land. If it had kept up to its original or final strength, we might easily have had other casualties in the search parties.

The recital of dreams, as furnishing outside interests of a sort, was occasionally tolerated in the hut. I wonder if most people go through my dream evolution? As a child, a feeling of terror, often that primitive idea of falling and never hitting anything, which is a survival of tree life. Later, the growth of a belief that the dreamer himself never gets hurt. And then in the late 'teens the comfortable realization that it's only a dream, to be followed by "dreams within dreams"; and, finally, at the age of thirty by logical reasoning while dreaming.

I noted that we had been south six months before I began to dream of snow and ice, and this perhaps is of psychological interest. In one dream "I was climbing up above Grindelwald, aided by a New Zealand guide, in company with Dr.

Bill. We got 'bushed' on a high peak near a hay-stack. I had a talk with Dr. Bill, in which I said that I had dreamt that the guide was going to take us down an easy way, which he wanted to keep dark, as he'd discovered it and wanted to keep it for *rich* tourists. We both smiled at this fool dream. Then I really awoke, and I suppose my sub-conscious self is still smiling on 'Hay-stack Mountain' in the Grindelwald!"

The ponies were snugly housed in the stable along the lee side of the hut. Their stable was built of the blocks of compressed fuel, and was quite a snug abode. They were rather vicious little beggars, and a walk down the narrow "aisle" meant a risk of a bite or a kick. Oates and Meares spent a lot of time in the stable making blubber and seal pemmican for the dogs. The western party had nothing to do with the ponies, for only those who were leading the ponies *south* were responsible for exercising them. In midwinter some "fearful wild fowl" took cover in their shaggy coats, and occasioned Captain Oates much trouble.

I noted this in my journal as follows—

"Baron Bernard du *Day*, Messenger from Captain Titos *Oates*.

"Greetings to *Debenham*.

"Wilt thou peril thyself so far as to visit the stable, and for payment of one straight-cut cigarette an hour, comb the manes of ye Siberian ponies to catch ye intrepid and adventurous louse?

"Debenham meekly leaves his rock sections, and hies him hence!"

Some of the game from the Pony Coverts was exhibited by Atkinson under his microscope. They resembled white ants in wind-helmets! No legs appeared in the specimen, so I asked if they had been worn off in the chase, but the indignant exhibitor was silent.

During the autumn another grotto had been added to our outlying villas. This had been cut out in the glacieret to house Wright's pendulums. We called it the "Cave of Pendullum." It was usually drifted up, and we had to cut down to the sacking door, being careful not to chop the tele-

phone wires. Inside, in one corner, was the telephone-box, well crusted with ice, through which he could hear the ticking of the sidereal clock in the hut. There was also a delicate apparatus from the Cavendish Laboratory at Cambridge to register the "ionization of the air," and a microscope and micro-camera. On an ice bench was the chief instrument, a stand carrying four short pendulums. Each was mounted on an agate knife-edge, and was surmounted by a mirror. The time of swing of these pendulums was very delicately measured, and gave the *pull of gravity* at Cape Evans, thus leading to an estimate of the shape of the earth.

This account is somewhat brief, and this is explained in my journal as follows: "This description has been greatly interrupted by the irruptions and incursions of the Anti-Feminist, who *will* pour out his antiquated views on 'Woman's Mission in Life' into the unwilling ears of Debenham and myself. His only semi-sane argument is, that as all laws rest on an appeal to force, and as men are physically stronger than women, therefore men must protect, must rule, and (apparently) therefore must control and administer all the laws! The rest is pure selfishness."

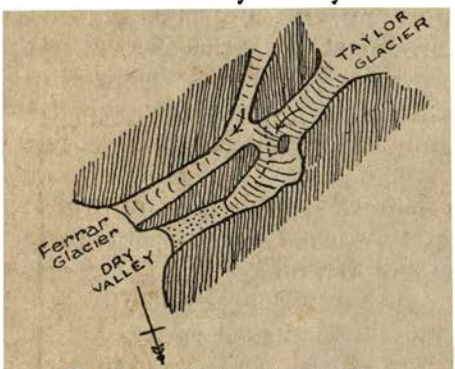
Tuesday (11th July) was Jam Day, as I write with glee. There are two articles of diet to which I am not particularly addicted, and they are cheese and sardines. We got cheese *solus* for four lunches a week, and sardines every night watch. So that I used to reckon by Tuesdays! I proceeded to translate German glaciology as usual, but unfortunately Debenham and Nelson started a cag on the merits or demerits of Australian tennis champions; and when that was over we had another as to which was the worst storm in the *Terra Nova*. Nelson said it took place off Cape Town, Wright said off St. Paul, Atkinson said south of New Zealand. All this talk occurred in our cubicle, and as Debenham and I had not experienced the two earlier excitements, we were not violently interested, and tried to push the debaters out, with complete lack of success. I did very little German!

On the 12th of July we had a record blizzard. For over twelve hours its mean velocity was above forty miles per hour, and it rose above seventy miles per hour at 9.15, 11.15, and 5.30. At 9.15 p.m. it fairly boomed over the hut. Luckily the hut is so surrounded by "lean-tos" and great snow-drifts

that the wind is led gradually on to the Hut, else it would surely have blown us into the sea.

This blizzard was accompanied by relatively high temperatures. It roared all that day, but after lunch, on 13th, I write: ". . . it is getting cooler; none of that oppressive heat of +8° F. (24 degrees of frost), and is now much nicer (−7°); so that the leaks have stopped, after damping Gran's mattress considerably." The lunch was evidently cheese, so that I confined my attention to brown bread, dripping, and cocoa. We were able to leave the Hut in the afternoon, and walked up to Bertram. Skua Lake was so brilliant, I thought at first it had melted, but it was merely polished like plate-glass by the furious drift.

Teddie Evans had been engaged for some days on plotting the chart of Dry Valley on the first western journey. He made a fine drawing, with "form-lines" inserted, so that the shape of the glacial valley showed up splendidly. Captain Scott, Evans, and myself discussed the naming of the new glaciers, etc., now first charted. We had given some of them provisional names on our journey, and the Owner chaffed me somewhat, but said he didn't mind a bit. There were two distinct glaciers included in the Ferrar Glacier, which Scott had named in 1903. He asked me if the one entering Dry Valley was going to be described as a type; and I said that its exposed bed was probably unique in Antarctica. Then he said, "We'll call it the Taylor Glacier." So that on 15th July I became a cartographic entity!

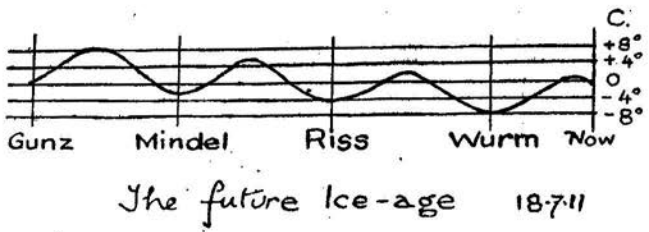


The Twin Glaciers (copied from diary, July 15, 1911).

One of the most interesting paragraphs in the German tome through which I was laboriously wading tended to show that the world was approaching another Ice Age rather than leaving it behind.

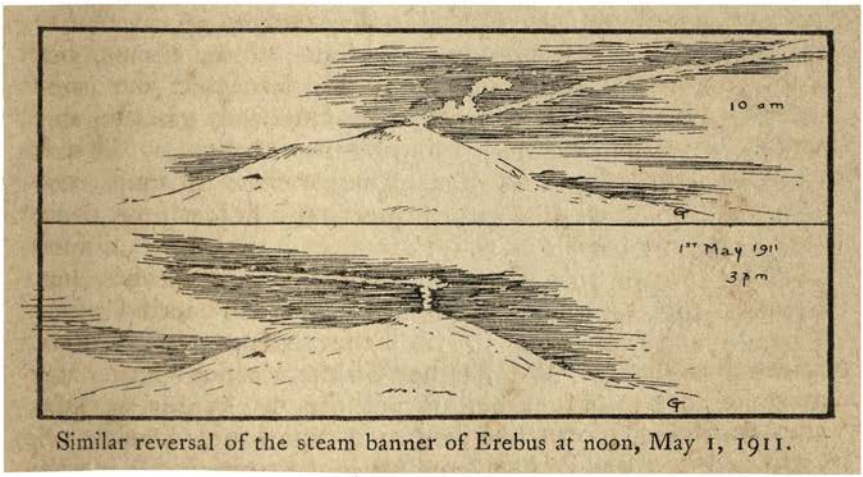
In the Swiss Alps the Germans have shown that there were no less than four Ice Ages included under the last glacial

epoch, separated into three inter-glacial periods. The general temperatures can be obtained by studying the depression in the snow-line and the position of the moraines in these four



Ice Ages. It really looks as if we were now in an *inter-glacial period*, rather than permanently free from glacial conditions. However, the next Ice Age is seventeen thousand years off, even by the lowest computation.

I was able to make a characteristic sketch of Erebus on the 18th July. The steam cloud extended across an arc of 90°,



Similar reversal of the steam banner of Erebus at noon, May 1, 1911.

and appeared to be drifting *to* the south. The banner was possibly a hundred miles long. On the surface there was a cool southerly wind, in just the opposite direction. Several fine undulations showed in this banner, and at times a hummock of steam over the crater pointed to extensive outbursts of vapour. Far to the south the banner was very faint, and reminded one of the Milky Way.

The dawn colours were very beautiful. We were not to

see the sun for over a month, but over his position were belts of crimson lake, dull red and green, with pale blue above.

Sometimes the dogs would accompany us up the Ramp. Atkinson and I went up to read Bertram on the 21st, while Stareek and Tsigane trotted alongside. The latter is quite sociable, while Stareek, one of the leaders, is one of the most imperturbable. According to Atch, he has been seen admonishing Tsigane for his undignified behaviour!

These walks were good exercise, but the weather was getting colder (though mid-winter was past) and $-35°$ was quite common. My first occupation on reaching the Hut was to go and hold my head over the stove. After some minutes the lumps of frozen breath which surrounded my mouth would melt somewhat, and I was able to free my beard from the flannel of my helmet!

After Church service on the following Sunday (23rd), Ponting gave an exhibition of cinema pictures in his dark room. It was a very select show, as there was only room for an audience of four! His films were *negatives*, so that the black and white were reversed. Under these circumstances the seals appeared white and more slug-like than ever, while the white shadows following the penguins were most uncanny. While we were in the dark room Simpson called out that the wind was still rising. It reached eighty-four miles per hour at 8 p.m., which was the record during the first winter, though this was easily beaten in 1912.

The 26th of July was a splendid day, and without doubt marked the return of daylight. Simpson and I visited Bertram and were able to read the thermometers without recourse to fusees. We marched on the Erebus Glacier some distance, and found numerous potholes in it, due to stones sinking therein. On our return I continued plotting the chart of the Koettlitz Glacier. Wright is obtaining interesting results from his ice sections by "rubbings" of the ice striæ with a soft pencil. These photograph quite well.

We were well stocked with books in the Hut. Almost every officer had taken down some standard novels in addition to a few text-books, and curiously enough there was very little overlapping. For instance Cherry had a row of Kipling's works which almost all of us appreciated, Day had Dickens, Debenham had four or five poets, and more popular still—a

collection of thirty "paper-back sixpennies," which every one was always borrowing. He kept them in a box under his elevated bunk, and I remember one evening after we had turned in, some one came into our cubicle and started burrowing about. Debenham said, "Now then, what are you after down there?" A voice replied, "Where do you keep those sixpenny novels, Debenham?" It was Scott, who couldn't sleep, and wanted some light literature!

I had two or three of Wells, Browning, Tennyson, and "Martin Chuzzlewit." However, though *my* library was small, I used the official library more than any one! I have mentioned elsewhere the splendid little library of standard fiction presented largely by Mr. Reginald Smith. This consisted of about 250 portable volumes published by Smith, Elder and Co., and by Nelsons. There were Merriman's, Brontë's, and Conan Doyle's, and all the shilling editions of noteworthy books by authors like Gosse and Belloc. Mr. Mackellar gave us many other volumes, especially some small art books. These lived in Day's bunk. Then Admirals Markham and Beaumont presented us with many rare copies of books on Polar Exploration. These were constantly being read, especially by Bowers, whose lectures on sledging rations and polar clothing led him to read every word. Candidly I must admit that it was not cheering—when the blizzards were booming over the hut and all was dark around us—to read of Greeley's awful suffering in the Arctic, where forty out of fifty men perished; or of the loss of the *Jeannette* and her crew in Siberia; but still the volumes were always being referred to by one or other of the officers.

We had several larger books, Haydn's "Dictionary of Dates," which didn't seem to be much troubled, and Harmsworth's Encyclopedia, which was always in demand. Cherry had the large *Times* Atlas, and we had Paul's "History of the 19th Century," and Harmsworth's "History of the World." Oates brought along Napier's "Peninsular War," and rarely seemed to read or need aught else. I had a bet with him that I would finish Paul's six volumes before he had read through Napier. However, neither was completed, though Oates was a long way ahead! Scott had a shelf of poets and a number of foreign novelists, chiefly Russian and Polish.

I had finished all the lighter literature in about three

months, and thereafter was able to advise some of the others as to works meriting their fleeting attention! It occurred to me that it would be amusing to try and discover the tastes of the fifteen officers of the hut. Books were naturally often discussed. Oates must have been reading some of Merriman, for I find that Simpson took exception to his praise of the latter's works on meteorological grounds! This seems rough on Merriman; but Simpson said it was not possible to see the *midnight sun* at Tver, and he also objected to the wrong use of the word *parhelion*. I'm afraid I'd missed these "professional errors," but I remember what seemed a serious flaw to *me* in Davis' "Soldiers of Fortune" (otherwise a rattling yarn), was the author's weird geological description in the first chapter! Similarly we expected Captain Scott and Seaman Evans to revel in Kipling's sea yarns, whereas they were not enthusiastic. Both made the same criticism; Evans saying that there seemed to be a lot made about a little, and that, "anyway things isn't so concentrated-like in the Navy!"

I hope living authors, if they ever read this, will rise superior to our criticism! Debenham didn't like "Kipps"; in fact, except for Wright I couldn't get a word in favour of Wells. Even Nelson, who liked reading "Anne Veronica," declared it was a piece of satire from beginning to end, in which Wells was obviously gibing at his readers! The only book Nelson and I liked in common was Gissing's "Born in Exile," and I grieve to state that the "Owner" characterized this as "Tosh!" "Richard Yea and Nay" is loved by Debenham. I couldn't read it, and declared it was not free from gross errors. (*Pace* Hewlett!) Challenged thereon, I said I had visited the castle at Gisors, and that it was still a well-preserved ruin, whereas in the novel it is "*razed to the ground.*" This, of course, led to a cag on the meaning of the word *razed*, in which all the hut took part, and I've no recollection as to who was supposed to have won! Any Canadian novel that was appreciated by one man, would be caustically slated by Wright. I think we were all better at criticism than appreciation. Chambers' "Fighting Chance" was damned "because the hero kisses a girl under water"!

However, as a result we began to get some idea as to each other's tastes in literature. I was a sort of referee, in that Ponting, Day, Debenham, Wright, and Simpson, would some-

times read a book on my recommendation, while Meares, Oates, and Nelson, always went for what I didn't like!

We had very strong winds about this time, and were very anxious to know how the Cape Crozier party were progressing. They were due back, and had had awful weather judging by our experience. On the 29th Atkinson and I made our usual excursion up the Ramp to "Bertram." There was no drift, but the wind rose to fifty miles per hour at times. We could hardly keep up on the ice, and I was actually blown bodily off the little cone on which Bertram was erected. Later we went out to "Archibald," letting the wind blow us there. Scott said he saw us start, and when he looked again in a few minutes we "were mere dots on the horizon!"

But it was not so easy getting back, and I only managed it by bending double and watching our outward tracks.

On the 1st of August I went on night watch at 8 p.m. Most of the men were turning in, when Hooper called out, "Here's the Cape Crozier party." So we all rushed out and there were the three of them. Cherry staggered in looking like nothing human. "He had on a big noseguard covering all but his eyes, and huge icicles and frost stuck out like duck's bills from his lips! They had been away five weeks and a day, and it had been hell all the time practically. After leaving Meares and Sunny Jim, they had pushed on and camped four miles this side of the 1902 Hut. The next day they camped on the Barrier. There had been but little snow on the sea ice, though a snowdrift led them up on to Barrier. Here awful soft snow began, and it was very cold. They had to relay most of the way, and sometimes even with one sledge they could hardly get a move on. It was like pulling in soft sand, and often they only seemed to be marking time.

"It took them three weeks to get to Cape Crozier, and they remained there ten days. They were unable to get any blubber and had to return when only one tin of oil was left. Blizzards held them up off Mount Terror, and here Birdie is credited with sleeping three days and nights (bar meals). The other two didn't! They spent three days building a stone igloo, and pitched the tent to leeward. A tremendous blizzard came up and blew their tent away! They had now a poor chance of getting back, and proposed to dig snow holes

each night and cover themselves over with the floor cloth. Luckily they found the tent a quarter of a mile away, just on top of the sea cliff! They had camped just south of the big cliff under which we had rowed in January, 1911.

"All the ice blew off the Ross Sea with the force of the blizzard. They were only able to get down to the Emperor penguins on one day. These were nesting—if such it can be called—on a piece of old sea ice between the cliffs of Cape Crozier and the high Barrier Ice. They had to crawl down between the Barrier and the Rock Cliffs, and here Birdie stuck as his clothes had frozen so stiff! There were only a hundred penguins there, instead of 1000 as they had expected. They spent two hours getting down and could only carry away six eggs, of which three broke. Cherry says his mits were made warmer thereby! The temperature was down to −77° F. (a sledging record) and often below −60° F. Their sleeping bags froze stiff, and they couldn't roll them up, while Cherry's was too big and never thawed except where he touched it; moreover, they tore badly when they were getting into them.

"On their return they could only make one mile on the first day, and Birdie went down a crevasse to the length of his harness. They managed to get him up by a bowline on the alpine rope. On the last three nights Cherry said that no one slept. They used to doze on the march and over their meals, but were too cold in the bags. On emerging from their tents they had to be careful to hold their heads as they would bear them later, for their clothes froze and held them like a coat of mail!"

About three miles to the south lay *Tent* Island; so called because in 1904 the men cutting a canal through the ice had their tent there. Atkinson and I walked over there early in August, to see if we could find his belt, which he had lost on July 4th. I carried a plane table to continue my survey of these islands. It was extraordinary to see footprints in the gravel, which must have been made by Priestley in 1907, though they looked as fresh as my own.

We visited Clarence on our return, and found it to be much less imposing than Archibald or Bertram. Merely a little box at sea-level, containing two thermometers, but no stand or cairn. It was getting gloomy and we just returned

in time, for Atkinson's feet were pretty well gone in his old finnesko.

It is a queer fact that both Atkinson and myself dreamed that the Cape Crozier party were returning on the night before they arrived. In *my* dream I modestly went out and pulled their sledge back. However, I don't think we published their approach on the strength of these dreams, else we might have claimed some credit for our superior intelligence!

When there was no wind it was quite pleasant strolling about by the light of the moon. In the long winter night it was cheering to realize that we could tell *where* the sun was even if we hadn't seen him for over three months, for the moon's brighter face of course points to the sun. This comforting deduction led to the following astronomical effusion in *S.P.T.* :—

THE ERRANT SUN.

Throughout the night,
Nor life nor light,
  E'er chases gloom away ;
But still the moon
Foretells full soon,
  Arrival of the day.
For each bright ray
Shot to the day,
  By Luna's silver bow,
Transfixes straight
Her lucent mate,
  The errant sun below.

I wrote at the foot for Dr. Bill's edification—

"If your artist can rise to the occasion will he please illustrate this poem (*sic*) with a sketch?" and to this note there hangs a tale as shall appear later.

Wright and I went off for a tramp towards Inaccessible Island. We came across some of the queer snow stalactites which I called "Cold Feet." They were due to snow collecting on the ends of icicles where they were somewhat sticky. The snow built out a "foot" to windward, and they looked exactly like long white stockings.

Near the big icebergs Gran pointed out to us an Emperor penguin and yelled to us to kill it. On approaching it,

however, it objected strongly, having legs and arms and answering to the name of Lieutenant Evans!

The pressure of the sea ice had raised great ridges of ice around Inaccessible Island. Some cakes of ice were most precariously perched on the top of these six-foot hummocks. The queer structures resulting from the buckling and cracking of this six-foot thick sheet of ice reminded the geologists very strongly of the type diagrams used to illustrate the major folds and earthquake cracks in the earth's crust.

On the 4th of August we made a real start for the summer campaign by taking the two motor sledges out of their winter quarters. "It was frightfully heavy work and took about twenty of us to move one a foot. I wouldn't care to go over a snow-lidded crevasse in one."

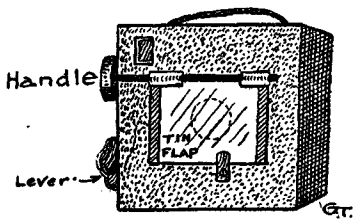
Simpson gave us a good lecture on General Meteorology in the Antarctic.

I thought Simpson didn't lay enough stress on the purely *local* character of our storms. I said that he reminded me of a minnow living behind a stone in a big river, wildly excited over every eddy and paying more attention to them than to the river as a whole. This "cag" between the scientists greatly delighted certain of the ribald, and Simpson was referred to as the "minnow in the eddy" for some time thereafter.

The usual occupations filled our time during the first fortnight of August. I was busy mapping the vicinity, translating German geology, calculating sledge stores, and writing a long article on the Inmates of the Hut for *S.P.T.* On the 14th I wrote, "To-day is a beautiful day, with a temperature of −38° F.; but with no wind, so that one can stay out quite comfortably. It is very light now, for the sun is due in five or six days. Erebus is very active, and is puffing up big gouts of steam. Debenham measured one which rose 4000 feet in ten seconds! The banner then sweeps south and east. It is lit up by the hidden sun in a most beautiful manner. I say the colour is tawny, Atch says russet, Birdie burnt sienna, while Bill says it's a mixture of vermilion and yellow ochre! Anyway it is very pretty, and Debenham says he can see inside the crater."

Through falling into a small crevasse I found some beautiful ice crystals above the Ramp. Later I turned up some

slabs of ice which had covered old water channels and their lower surfaces were sparkling with beautiful basket crystals half an inch across. In some cases these were branched like candelabra. Wright managed to photo some of them satisfactorily, for unlike our rock collections, *his* specimens were extremely fragile and hard to preserve. I renovated my smaller camera which had suffered so in the gale. After I fitted it with a simple "flip-flap" tin shutter, this piece of apparatus was always called the mousetrap.



The Mousetrap Camera
14 8·11

By this time most of the diarists had lost their early enthusiasm. The Owner wrote an hour or two each day. Gran and myself were probably the most voluminous writers. Debenham, Cherry, Wilson, and Simpson also kept records; but most of the others affected to despise diaries. Wright would bring his along once a fortnight, sometime when I was engaged on mine, and look through it for references to himself. We often went for a walk together (invariably towards the Erebus Glacier), so his diary was often something like this—

Aug. 1.—Went up the Ramp with G. T.
„ 2.—Ditto.
„ 3.—Ditto.
„ 4.—No entry.

I suggested he should fill in his blank days with "Did *not* go up the Ramp with G. T."! The "illiterate" took a great, if transitory, interest in our labours. Birdie seeing me stuck for copy on August 13 sang out, "Write—Turned in, turned out; ditto, ditto. That'll fill your diary!" Atkinson assisted as follows: "On night watch; slept till 10.30; woke up and was very pleased to see Atkinson, because he's such a good fellow!" Cherry's quota, "We have many cags on scientific subjects and so acquire much merit." While Uncle Bill, with a merry twinkle, added, "And next week we'll get on to some serious work!"

I think the seamen enjoyed life in the Hut as much as

any of us. The night watches must have pleased them immensely. To see a weary officer nodding and shivering all through the night, while they were snugly rolled in blankets and enjoying an uninterrupted night's rest, was just the state of things they would appreciate! As I have noted already, some of them unconsciously imitated Kipling's Emanuel Pycroft in "Bonds of Discipline," feeling they might never have the opportunity of reprimanding an officer again, they would pour out (from the shelter of a bed curtain) the vials of their wrath on any unlucky watchman who fell over the fire-irons or discomposed their slumbers! It is fair to state that in the next winter they cheerfully took on night watches, and were quite equal to reading all the meteorological instruments.

The 15th was a rather threatening morning; the wind coming from the west, which was most unusual. "Debenham says this implies a blizzard. Every one has a different theory of blizzard forecasting. Mine is simple! If you've had four days fine, you're sure to get a blizzard! This works well in winter."

"Last night we had an addition to our Antarctic family. Innumerable pups accrued to us, descendants of our long-haired collie, 'Lady,' and the Siberian dog, 'Beely-glass.' They occupy a corner of the stable, and add life to our ménage. Julik went off some time ago, and is undoubtedly lost; though it is difficult to see how, unless he got into a deep crack. The other day Peary and Cook and another dog (harnessed to the cook's light sledge) bolted. They tipped Clissold into the tide-crack, and made for Cape Royds. Luckily, Atkinson managed to catch them. Tsigane, Peary, and Cook are the only dogs I'd care to take back." The others were too unsociable, and though by no means savage when well fed, they were little interested in their owners' doings, and exhibited none of the so-called dog-like affection.

Wright and I walked south over Cape Evans, and above the curious belt of moraine, which we called Land's End. It was pretty cold, for Evans found the mercury frozen that day at Clarence; but as there was no wind this did not affect us after the exercise made us warm. Sometimes one could feel one's nose "go with a ping," as if the blood had really solidified in one's veins. But vigorous rubbing and nursing in

the warm palm of one's hand usually restored circulation. As long as one's heat energy was abundant there was no risk; but when vitality was low, through fatigue and hunger, frost-bite was certain in any cold extremity.

As we walked over the Erebus Glacier we noted numerous circular dark patches in the ice. These exhibited maze-like patterns (arabesques), and marked where stones had sunk through the ice. There were no stones visible on the surface, and no source of supply, so that either these were very ancient, or else they were due to the effect of the sun on stones deep buried *in* the glacier ice. The Land's End Ridge was a mile long and only a hundred yards wide. It was most precariously placed between the glacier and the deep sea, and was perched on a line of cliffs which were just uncovered by the retreat of the glacier.

Monoliths of kenyte lava and ash (tuff) were scattered along the moraine. Great debris-cones, capped by huge unweathered blocks of kenyte, rose to thirty or forty feet high. The Land's End cliffs abutted on the crevassed piedmont glacier to the south, and from their 150-feet elevation we could see the curving crevasses crossing the glacier, and could determine that the "ice-caves" were but these crevasses seen in vertical section on the ice front.

To the south extended a fine view of Turk's Head, and the long promontory to the Hut Point. We returned towards our hut, and attempted to reach the sea-ice from the moraine. In the dim twilight we judged that there was a twenty-foot gully between us and what looked like an iceberg. When we dropped into it, it was only four feet deep! So deceptive is a snow surface in the absence of light and shade.

The next day was cold again ($-35°$), and Gran and I climbed Inaccessible Island. I carried a theodolite, and fixed it on the top (521 feet). It was awfully cold work. I had to remove my fur gloves, and my fingers "went" very soon, and standing still made my toes lose feeling also. By the end of an hour I could do no more, and was so numb that I could not put the theodolite back properly in its case. My fingers and toes ached badly all the way home, but had recovered on arrival.

I went out to the rubbish pile and commandeered enough material for a book-binding kit. I bound up some glacial

pamphlets into two pieces of "venesta wood" from a packing-case. The rest of the case made the sewing frame. Two iron clamps, lent me by Simpson, made the press, while I had found a queer residue in the glue pot, which I used in default of better. Towelling for head border, and tent cloth for the back completed it. Next day I wrote *Hoc Pegit* in what is probably the first book professionally stitched and bound in boards in Antarctica.

Atkinson gave us a clear and concise account of scurvy, from which I gather that our chances of seeing any are few.

LECTURE ON SCURVY

By Atkinson

History: Scurvy was a dread disease about the end of the 18th century. Anson lost 300 out of 500 men from scurvy in 1795, but about that time Blaine introduced the use of lime juice, and since then it is practically unknown in our navy.

Symptoms: It is a general non-febrile disease, and not contagious. It is marked by mental depression, syncope, and debility, and the morbid blood arising often causes characteristic patches on gums, thighs, etc., like bruises. Atkinson modestly ascribed the cure to the Naval Medical Corps (loud cheers!). He said that immunity was possible, and was assisted by plenty of lemons and other vegetables (*sic!*).

Detection: Ralph found that if you gave too much acids to animals they got scurvy, and Wright also believes it is a form of acid intoxication. Serum is obtained from the clotted blood of the patient. This should be alkaline in reaction, and its alkalinity is tested by neutralizing it with various strengths of sulphuric acid. Thus $\frac{1}{30}$ or $\frac{1}{50}$ normal strength of acid should be neutralized by alkaline serum. If only $\frac{1}{90}$ normal acid $\frac{N}{90}$ is necessary to neutralize, then "you have your scurvy."

Prevention: Fresh meat alone does not prevent scurvy, since they had plenty of horse in the siege of Paris, and yet suffered heavily. Possibly it is too acid. Fresh vegetables seem to contain an alkaline salt which is helpful, and possibly sodium lactate is a useful drug. Nansen, however, believed in change of diet as being very helpful.

In the discussion Uncle Bill said that many of the symptoms noticed after sledging were purely due to the lowering of tone. If one entered upon hut life gradually by living for a day in the annexe you wouldn't feel funny feelings in your toes! "I asked if a vegetarian diet would do down here? We

have no fresh vegetables, but we have bread, butter, cocoa, sugar, jam, porridge, tinned fruit, tinned milk and cheese. (I lived on a less varied diet in Cambridge, only I still don't enjoy the cheese lunches where the pungent stilton stalks around, and the exclusives have to collect together and wave the phantom off.) Bowers said that Bill developed spots on his face on the Crozier journey; but Bill swore they were beard sprouts. Birdie had been nodding a bit, so I said he was evidently scorbutic, as he exhibited a tendency to syncope, deposit of fat, and an inflamed head (a cruel hit at his red hair). Ponting had been listening anxiously to the doctor's criticisms of sausages, and various potted meats, and then read us a cable he had received in November announcing that a friend meant to send a half ton of sausages by the Relief!"

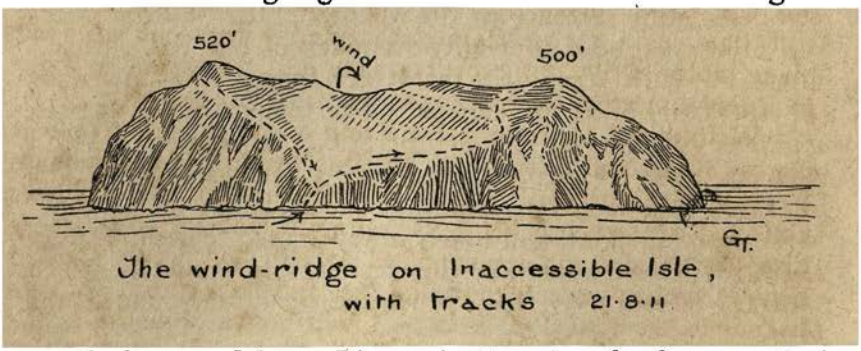
On Saturday night (19th August) we experienced the maximum wind pressure of the winter. "It rose from forty-five miles per hour to eighty-six miles in one fell shriek." There was such heavy drift that it blew through the outer walls (of cases) and filled the annexe. The temperature had risen astonishingly, for we found "Bertram" registering $+\frac{1}{2}^{\circ}$ F., whereas a day or two before mercury was freezing! The blizzards were sometimes accompanied by a sort of "foehn" wind warming affect, and nearly always raised the temperature slightly. They swept away the stagnant heavy cold air which collected at sea-level, and which normally surrounded the Hut.

The 21st of August was a calm, clear day. The sun was due in a day or two now. Nelson was having some trouble with his soundings at the "Igloo." So seven of us marched out to help him free his rope. It was quite a procession, Nelson going first to fix a block and tackle (pronounced *taikle!*) on his obdurate rope. Then Atkinson and Clissold—who worked the fish trap, and so were professionals in such jobs—walked along in a dignified way. Then long Day on ski, followed by Debenham also on ski, and causing some amusement by his "croppers." Finally, "Trigger" Gran started long after us, and "flapping" along on his ski easily caught us up. I could easily keep up over a couple of miles without ski, but over a longer distance there is no doubt as to the advantage of the ski. We all hauled on the "taikle," and so broke Nelson's rope away

from the bottom, where it seemed to have frozen in. Then dropping the "earth" wire of his telephone circuit into the water I rang up Simpson in the hut, and heard him with great ease through the bare aluminium surface wire.

Debenham and I climbed Inaccessible Isle to try and see the sun first. We went up by the usual route, but had to kick steps in the thick snow which now covered the gravel slopes. There is a magnificent windblown gravel ridge on the lee side of Inaccessible Isle. The blizzards shoot *up* the southern face and drop their dust contents beyond the central notch on the northern slope in the form of a long ridge about fifty feet high.

We obtained a fine view of the western cwm valleys below Mount Lister from this elevation (520 feet). To the north we could see a bright glow over the Barne Glacier and good



The wind-ridge on Inaccessible Isle, with tracks 21·8·11

sun shadows on Mount Lister, the first time for four months! But we did not see the sun's disc at all.

The sun was due on August 22, so it was natural that a blizzard should spoil all chances of seeing him! We took him on trust to the extent of champagne at lunch, when Scott toasted Lieutenant Campbell's birthday also.

"A snorting blizzard; never saw such thick drift. It wet one, so that one's hands froze in no time. None went outside the hut."

The table resembled a grocer's shop from now on, for Birdie started bagging provisions for the sledge journeys. Pemmican was taken out of the tins, broken up, and bagged first, and then cocoa, butter, sugar, in fact everything but biscuit, which was left in the 40-lb. tins as sent to us.

"2.30 a.m. on the 24th.—It is now my night-watch, and

I have finished making the slides for my next lecture; I have read M. Beaucaire, had two slices of toast, gone on the roof and cleaned out the blizzometer tubes, and washed my feet. The sooner 3.30 arrives (and Nelson with it) the better!

"In two months we shall be away on the veldt again. I have lots of prints to make, and must continue my German and physiography; but I have done about as much as I intended, and found the winter a very pleasant and busy time. It is wonderful how exhilarating a fine day is, though the last few days have been the limit."

Next day it was still blizzing, with the temperature up to +11°! The drift was lower, and Nelson managed to get out to his igloo on the sea ice.

Captain Scott asked Debenham and myself to map Cape Evans in considerable detail; while Lieutenant Evans carried out the coast survey and Wright obtained heights and ice-cliff data. As a result Debenham and I were out with our plane tables fairly continuously in the next few weeks and got to know almost every rock upon our little promontory.

Wright and I climbed the Ramp in our anxiety to see if the sun was still alive! but without avail. The clouds on Erebus were worthy of note. During the day huge billows collected to the south below the summit, and at 7 p.m. these disappeared, and the steam cloud (which had hardly showed before) shot up several thousand feet and then spread out as a banner to the *north*. This latter direction was unusual, as the upper air currents usually went due *south*.

On our return we found that Simpson had seen the rim of the sun about 3 p.m. from Wind Vane Hill (at noon it was hidden by the Barne Glacier), so that the meteorologist was the first to welcome His Majesty's return.

On the 24th I gave a lantern lecture on Polar and Temperate Glaciation. As usual Ponting kindly made most of the lantern slides and operated the lantern. Afterwards he showed us some of his magnificent Swiss slides.

On the 26th I managed to improvise a satisfactory plane table from a telescope tripod and my drawing board. We had a spare sight-ruler, and with this primitive instrument I successfully mapped my section of Cape Evans.

We could always orient on far distant peaks, such as the Matterhorn, fifty miles north-west; or Castle Rock, twelve

miles south; and this saved a lot of trouble with the usual "three-point resection" method. I climbed up the Ramp and read "Bertram." I could see the sun shining on Inaccessible Isle, and even on Hut Point far to the south, but it would need to get considerably higher before it illumined the Ramp. Lieut. Evans was setting up signal flags on the prominent debris-cones, and we returned together *viâ* the "Slippery Slopes," Evans justifying the name!

"Just before I reached the Hut I felt exactly like Peter Pan, and saw that I had regained my shadow! I walked up to Wind Vane Hill, and there was the old sun showing half his disc over Cape Barne Glacier! About 2 p.m. I went out with the 'mousetrap' camera, and took some photos to celebrate the event. I gave four seconds (with F. 45) on snow banks, etc., lit by the low-lying sun. This was too much, I believe, but the photos were fairly satisfactory and worth the trouble considering when they were taken."

Wilson reported some queer algæ deposits above Gully Bay, so we went off to investigate them. There were two layers (about fifty feet above the glacieret) in the soft kenyte gravel. I had little doubt that they were lake algæ which had grown when the water was held in by a larger ancestor of the present glacieret. Just to the west were beautiful examples of these ice-dammed lakelets, with "Glenroy terraces" marking various contours on their shores, just as in the historic Glenroy region in Scotland. Only in these Antarctic specimens the ice dams are still evident, whereas their absence in Scotland made the origin of the Scotch terraces a puzzle for many years.

I have made frequent mention of the debris-cones on the Ramp. Their origin was often discussed by Scott, Wilson, Debenham, Wright, and myself. Scott and Wilson believed they were dumped over at re-entrant angles in a bygone ice-barrier wall. Debenham compared them to the cones and hollows we had seen over in the western moraines and thought they were due to the melting of submarine ice. Wright and I believed them to be due to the weathering of huge erratics.

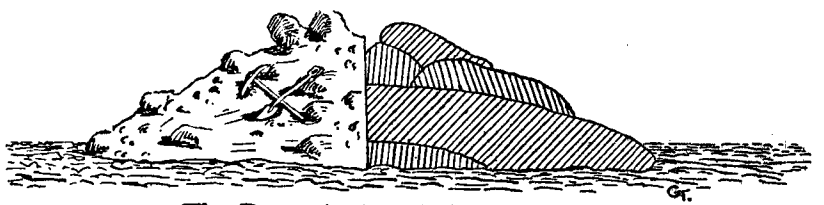
On the 27th Gran and I made the rather obvious test of cutting one open. It was six feet high and lay just on the edge of the steep slope of the Ramp, whence all debris would

LAKELETS OF CAPE EVANS, SEPT. 29, 1911.

Due to glacierets of drifted snow forming across small gulleys. (The drifts are always blown to the north.) These ice dams explain the formation of Glenroy Terraces, Scotland. The rugged outcrops of Kenyte Lava run chiefly east and west. The Tunnel Berg in the sea-ice appears to the west.

slip down the Ramp and save cartage. The upper face was a friable dry gravel. We heaved out two huge blocks the size of a man's body and found them fitting into other blocks of the same rock. We cleared away the top portion of one half, and then came to a huge block evidently extending to the foot of the cone and right through it. All this was frozen stiff into the kenyte soil of the Ramp, and it was beyond our powers to shift it. However, we had definitely proved that this symmetrical cone was solid, and was piled around a core of kenyte blocks.

"I met the 'Owner' after lunch and introduced him to the 'dissected cone.' He seemed to think it a strong argument



The Dissected Debris-Cone, 28·8·11

in favour of our long-held theory. Wilson basely hit back at me for upsetting his argument with a caricature in the *South Polar Times*, which is here reproduced.

"The difficulty in disposing of all the instruments needed by a geological surveyor is also hinted at in the gear encrusting the queer object on the debris cone."

"*August* 30.—A cold day, —33° with wind. Natheless, Deb and I went out about noon plane-tabling. I had finished my stations and carted the table about, filling in details. But it was mostly a 'cabman's war dance,' jumping and flapping one's arms to keep warm. I found that a great deal of the ice sheet to the north was only six inches thick over gravel, the latter appearing in the eddy gutters to the south of every big boulder.

"It got too cold to work, but I swore I would stay out as long as Debenham. Finally, at 1.15, I could stand it no longer, and made a beeline for the Hut, finding he had returned a minute or two earlier!"

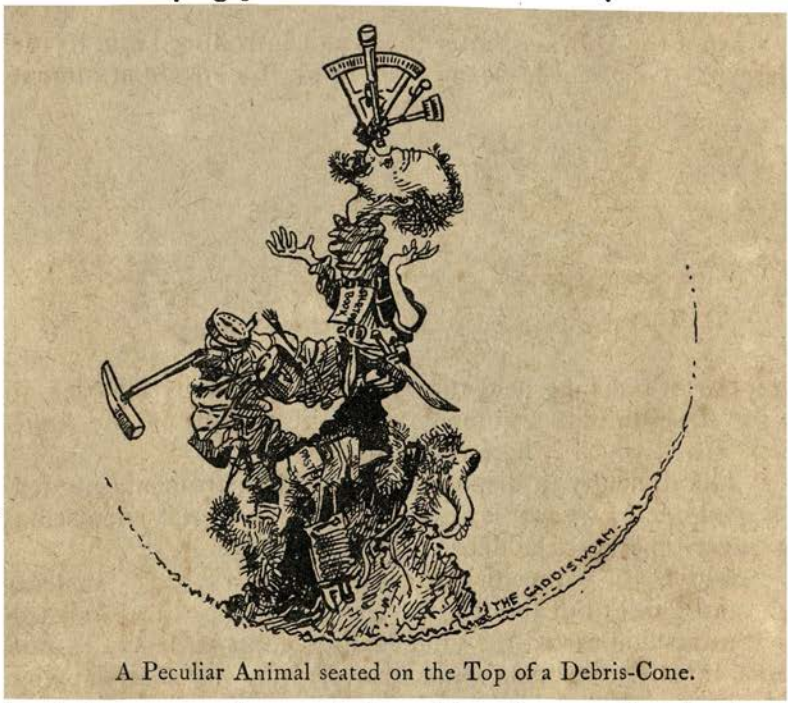
The next few days were similarly occupied. I made a pantograph (to reduce or enlarge drawings), and so obtained a

fairly accurate plot of all the sections of our map. The result is given herewith.

One can readily see some method now in the queer physiographic features of Cape Evans. It can be subdivided into several zones, which may be tabulated as follows, proceeding inland (east) towards Erebus :—

1. Kenyte cliffs and ridges, of rock *in situ* (about fifty feet above sea-level and chiefly to the south and west of the Cape).

2. Low-lying plains with lakes about twenty feet above sea-

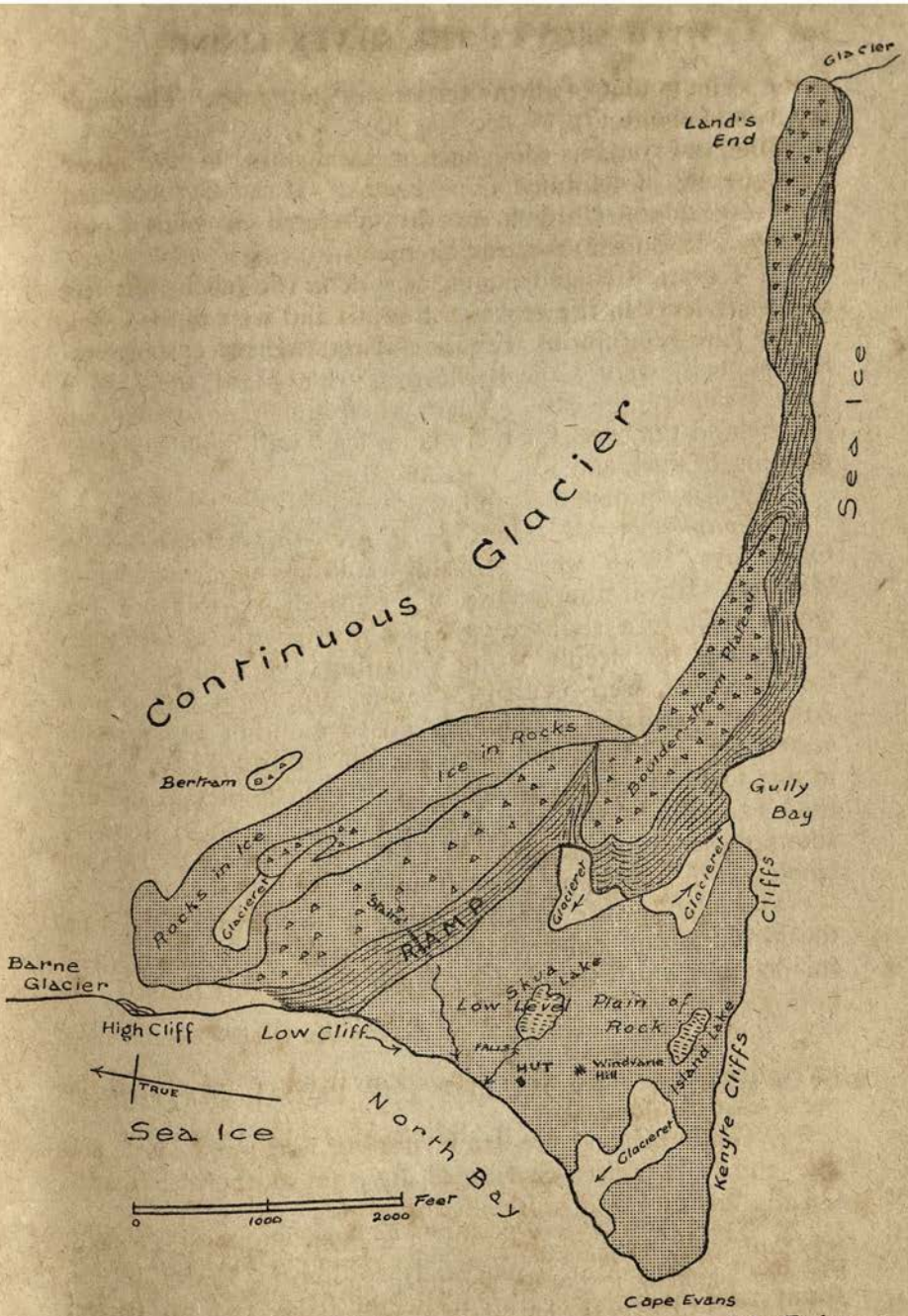


A Peculiar Animal seated on the Top of a Debris-Cone.

level, due to erosion and deposition from 1 (chiefly in the north-east of the cape).

3. Glacierets and ice-dams running north and south, and due chiefly to drifts distributed by the southern blizzards. On the low cape and on the Ramp also.

4. The continuous "Ramp"; a steep slope (30°) extending from "Low Cliff" practically to Land's End Cliff, *i.e.* about two miles. It varies in height from 100 to 150 feet above sea-level. Partly composed of rock *in situ* and partly of moraine just uncovered by the retreating glacier of Erebus.



Physiographic features of Cape Evans, due largely to the retreat of the Erebus Glacier.

5. The boulder-strewn plateau parallel to and east of the latter, and about 150 to 200 feet high. It is largely ground-moraine, but contains some ancient ice masses, and is affected by soil-creep or solifluxion.

6. A zone of large blocks (with ice between) which occurs chiefly in the north-east, and merges into the Erebus Glacier. Both 5 and 6 contain numerous debris cones, which are especially large in the south-east over Land's End cliffs.

7. The continuous Erebus Glacier which extends uninterruptedly from Cape Barne to Turk's Head, and walls in Cape Evans to the east. There is not much movement in it just behind the cape, for there is no ice "wall" but a gradual merging of rock and ice.

My diary proceeds as follows:—

"*September* 1.—I fear I must give this a miss. Titus Oates says, 'You were probably caulking and coughing, or blatting. But if the latter you'd remember!' (These rude words refer to a slight cough that worried me at this time. 'Caulking' is sleeping, and 'blatting' is arguing.) The Conservatives were evidently waking up, for I note one of Atkinson's remarks. Colonials go to London and murmur ceaselessly, 'Change and decay, in all around I see, Except in me, O Lord, except in me!' This misquotation afforded the 'True-Blues' (Cherry, Birdie, Titus, and Atch) great joy about twenty times a day. We Liberals scorned to use such feeble wit in upholding our principles."

The next lecture was one delivered by Birdie Bowers on the Evolution of Polar Clothing. I took fairly full notes of this lecture, which represented much reading on Birdie's part in our extensive library of Polar journals.

LECTURE ON "EVOLUTION OF POLAR CLOTHING"

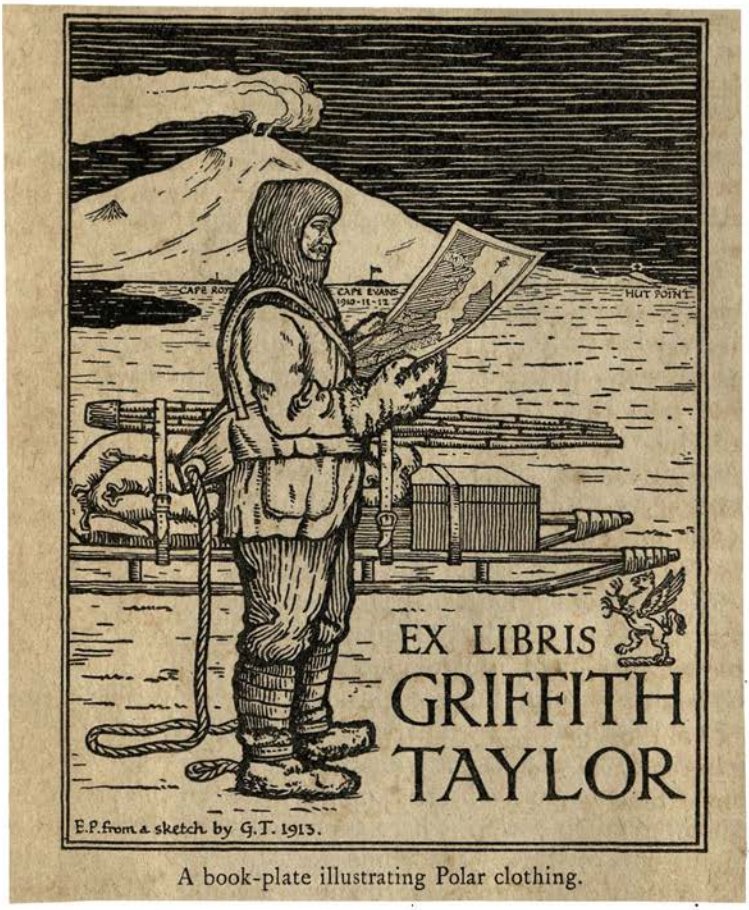
By Bowers.

September 1, 1911.

There are many fabrics which can be used, for instance, cotton is very satisfactory for some purposes, as we see in our windproof overalls. Fur was naturally first used, and Ross, on his magnetic pole expedition, was the first to employ fur sleeping-bags. Weddell found boots a great difficulty, and had to cut up all his gear to make new ones. Some Arctic explorers used blanket squares (sixteen inches across) instead of

socks. One must be careful not to have boot-soles too rigid, for this induces frostbite. It is curious that the Eskimo garments leave the skin completely bare at back and knee.

Bird-skin clothes are very warm and very light. In one expedition devices were painted on the backs of the white jackets to give the



A book-plate illustrating Polar clothing.

men behind something dark to look at, and so minimize snow-blindness.

With regard to mits, thumbless gloves are best for very cold weather. Greely had gloves with two thumbs, so that they could be used on either hand.

It is foolish to rub frostbites with snow, for the skin is chafed; flannel or a bare warm hand, etc., is better. Wool absorbs perspiration the best of all textures. White cotton does so to only half the amount. So the latter evaporates quicker, and soon feels chilly. Nansen says

goat-hair socks attract the moisture. "Oh! as you were!" No, I don't mean that! (G. T.—I find I've omitted the correction, however!) Personally, I think that an old sock makes an excellent nose-nip!

Sverdrup used to use a double tent for warmth with good results. I think we might modify the tent opening, and make the tent floor-cloth wider. If the sleeping-bags were provided with a separate hood, they would not get so wet. On our midwinter trip we found that eiderdown inner bags were no use after fourteen days. It was best to change sides with the fur bags and scrape them. The hair inside was warmer, but held the perspiration more.

The wind helmet should certainly be made fast to the blouse; and I think lanyards fasten the bag-flaps much better than toggles. These are the only improvements I can suggest in our clothing.

The seamen played six-handed euchre most evenings, while the two Russians looked at illustrated papers and turned in somewhat early. The mess-deck used to read the books in the library, and especially Debenham's paper-backs. When I ran short I raided their small private stock. I was assured by Taff Evans that one by Hichens "is no good, for no one in the mess-deck can read it!" Needless to say I did not always agree with this stalwart board of navy critics.

On the 8th of September the second volume of *S. P. T.* appeared. Cherry wrote the Editorial in the best style of the *Times*. Some eighteen pages were devoted to a skit on life in the Hut, called the "Bipes." Its redeeming feature is a series of coloured illustrations by Uncle Bill. In it I gave a somewhat garbled but recognizable view of various personalities at headquarters. The tenants of the Diarist's Den (*i.e.* our cubicle) as well as the Conservative party (the "Bunderlohg") came in for their share of attention on the part of the inquisitive rabbit; who is here supposed to observe the habits and customs of the so-called Bipes.

Simpson contributed a gruesome account of the decline and fall of the human race in the last days of the earth's habitation. The only panacea seemed to be certain elixirs to be obtained near Mount Erebus. There was a beautifully illustrated rhyme dealing with the midwinter party at Cape Crozier. I could never discover who was the writer unless it was the Owner himself. Simpson's career was described in a semi-serious article, "Celebrities in Glass Houses." There were two poems called into being by the return of the sun,

both due to Australians. Some one, I suspect Nelson, wove Uncle Bill and myself into a "nightmare interview." There were some beautiful photo plates by Ponting and three of Wilson's inimitable Egyptian tablets; besides various cartoons and silhouettes by Wilson and Lillie.

Guessing at the authors furnished considerable amusement. Even the astute Nelson fell in! On p. 19 there is a plan of the hut showing *inter alia* the engine in one corner. Nelson made the rash statement that Uncle Bill had drawn it the wrong way round. I immediately bet him that Bill hadn't. Nelson went over to the engine and came back ready to stake his life on it! Then I told him that I had drawn the plan; so that Bill couldn't have made a mistake! He proceeded to say that he would have put me down as the author of the "Bipes," only I was so unmercifully described therein; while Simpson amused me by assuring me that Scott wrote the poem, "The Errant Sun." I gave the palm to Nelson's poem on "Uncle Bill," "You are old, Uncle William."

Captain Scott was now preparing for a fortnight's sledge-trip over to the west. He proposed to Simpson that he should take this chance of some sledging, and so the meteorology was left in my hands. Simpson kindly coached me in the special minutiæ, and I started the records on the 11th (before he left), so as to get into swing.

Nelson gave us a particularly well-illustrated lecture on the 11th on Invertebrates generally.

He told us of the pleasant habit of the *hydra* which turns itself inside out, and converts its skin into a stomach lining, and *vice versa!* He discussed the huge arthropod, remarkably like a flea (but eight inches long), which Meares declared was found in a bunk in the hut, though Ponting said he obtained it on the beach.

We envied the Pycnogonids (sea-spiders), which grow an extra pair of legs in Antarctica, though they have only eight in less strenuous latitudes. Two more limbs would help us so greatly in sledging! He called on me to lecture on the corals, and I gave a brief account of the biology of the forerunners of this family (the *Archeocyathinæ*), which occur fossil on the Beardmore Glacier. I discussed Darwin's and Murray's theories with special reference to my

observations on the coral reefs of the Great Barrier. Debenham instanced Funafuti—that coral islet bored by Professor David to show the depth of a reef formation. Birdie wanted to know why a sea anemone wasn't a plant? And some one thereupon asked Nelson if he could explain why a Birdie wasn't a cabbage? But this problem proved too difficult for the lecturer.

Wilson with his usual kindness was now copying some of my western sketches and turning them into splendid pen-and-ink drawings. He spent many hours coaching me in drawing, but indeed he would always help any one if it lay in his power. I think what touched some of us as much as anything was his willingness to take the last and longest hour of any one's night-watch! He used to say, "I don't mind getting up at seven; I'll get on with my painting. Just put a kettle on to boil, and wake me, and then you can turn in!" I'm afraid I took advantage of this, when my watch lasted through to the morning, though usually I shared it with Nelson.

About this time Scott and Bowers spent their leisure in photographic work. Ponting was untiring in coaching them, and the excellent results obtained by these absolute tyros on the southern journey speaks well for teacher and pupils. Bowers handed over the pony "Chinaman" to Wright, who "gets run away with, with great regularity." Cherry was typing out those sections from the "Heart of the Antarctic" which would help Scott in his southern journey.

On the 15th of September Captain Scott set out for a trip to the Ferrar Glacier and thereabouts. They carried about 200 lbs. of food for us to Butter Point, where we were to pick it up later. Nelson and I helped them along for three miles, though the party, consisting of Scott, Bowers, Simpson, and Taff Evans, needed us little. It was −40° starting, but luckily there was no wind. A big shear-crack about two and a half miles out marked a permanent crack in the sea-ice extending between Inaccessible Isle and Cape Royds. It had developed into a fractured wall, as much as ten feet high in places, where the floes ground together, and gave us some trouble. However, Nelson and I were able to steady the sledge and guard the sledge meter, and so they soon negotiated it.

On the 17th of September we actually had a "fine bright sun, so that films of snow melt on the black rock." This is an interesting date, for though the air temperature was only +7°—that is, twenty-five degrees below freezing!—yet the radiant heat from the black rock produced a little water.

Let us accompany the meteorologist, and see how a first-class weather station is run at 77½° S. lat. The weather man has to rise about an hour before the others. (It was pleasant to see Sunny Jim lying in his bunk till 8.30 on the 14th—as he pathetically put it—for the first time since he'd landed!) I find I am dressed five minutes too soon, so I hit Wright with a book to get him up in time to check the chronometers, which is his "pigeon"!

1. When I hear the automatic signal I have to fly around and mark all the recording instruments to show exactly eight o'clock on their charts.

2. I read the large standard barometer and its attached thermometer.

3. Change the chronograph papers and put ink on the pens, for the blizzometer, thermograph, barograph, and wind velocity charts. (In all these chronograph drums the "clock" part (carrying the paper) revolves about the central axle—which is just the opposite of an ordinary clock!)

4. Wind up the various chronograph clocks (once a week, on Monday).

Then I muffle myself in wind-clothes and gloves, and collect the gear for the outdoor apparatus.

A. A clock set to nearest half-minute.

B. Sunshine paper for the record burnt by the glass ball.

C. Tablet and pencil.

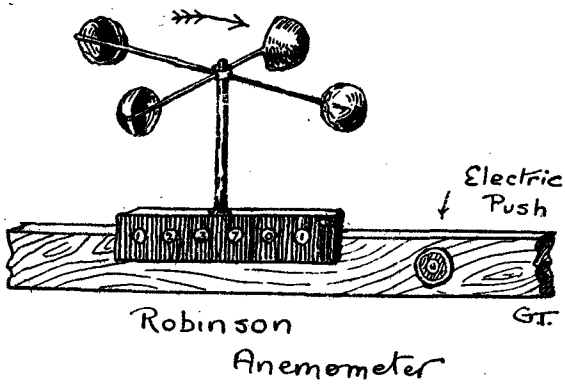
5. I stagger up to the top of Wind Vane Hill—a long operation and a cold one in September, for it is not far from August, the coldest and roughest month. At a definite minute I read the anemometer figures alongside the anemometer cups.

6. Then I press four times on a button alongside, and this is electrically transmitted to the record in the hut, and so gives a datum each day on that record.

7. I walk across to the screen and read the three

thermometers—present, maximum, and minimum. Then I readjust the two latter and read again.

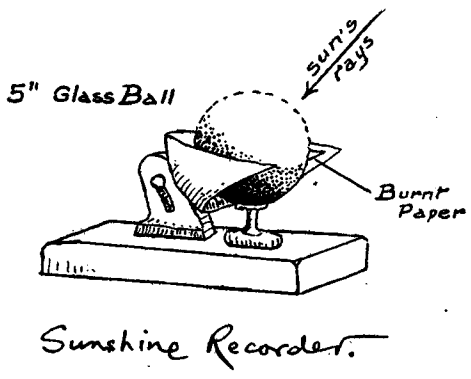
8. By this time three minutes have elapsed, and I return a few paces to the anemometer and read the latter figures again.



(This gives the revolutions in three minutes, and therefore the velocity per hour at that time. This is another check on the automatic record.)

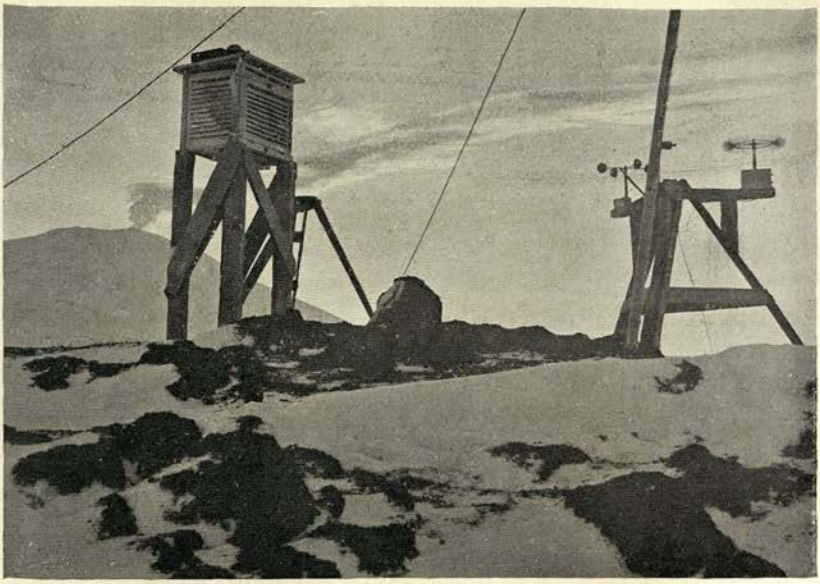
9. Read the wind direction from the arrow on the hill, and note the steam-cloud direction on Erebus.

10. Change the blue paper in the sunshine recorder and clean the glass sphere. This is an awful job, for the frost crystals cling like glue to the five-inch glass ball, and have to be melted off by rubbing with the bare hands. A slow and painful job at −40°!



11. Read the outside thermometer at the south-east corner of the hut, just below the anemometer tubes.

Each morning at 8.15 I used to predict the weather, as I went out to Wind Vane Hill. This was received with great joy by the mess deck. Crean was especially congratulatory. I have explained my method—*i.e.* "that after four days' calm



A FINE STEAM CLOUD BLOWING SOUTH FROM EREBUS, SEPT. 19, 1911.

The illustration shows also the station on Wind Vane Hill. The thermometer screen on the left, the flagstaff and the wind instruments on the right. One anemometer is rotating ; the other is blocked (for the photo).

A GLACIERET NEAR ISLAND LAKE (C. EVANS) DUE TO WIND-BLOWN SNOW, SEPT. 23, 1911.

The blizzard builds and also prunes these small glaciers. In the distance are the debris cones on the ramp and the south-west slopes of Erebus.

it's certain to blizz ;" and it worked as well as most weather rules. However, even when this standby failed, Crean was always consoling. At last the other seamen got nettled. "Go on, sir ! he's only kidding ; he wants your long sea-boots when you return !" It was "cupboard love," I fear !

On Thursday (21st) I believe the wind was blowing seventy miles per hour when I reached the screen. The temperature was pretty high (− 7°), but a wind that nearly blew me away soon robbed one of one's bodily heat. My fingers took about ten minutes to "come back," and only by degrees lost their dead feeling, though they did not reach the dead-white colour of bad frostbites.

The early morning sun was throwing fine earth shadows, which moved round quite rapidly. Thus on the 24th, at 8 a.m., Erebus cast a shadow right over the western mountains, while at 9 a.m. the shadow could be seen to the south-west of Erebus itself.

Debenham had been doing long-distance geology ! He fixed up a telescope and trained it on the south slope of the crater of Erebus. He could see hundreds of snow structures on the side, each representing the vent of a "fumarole" from which steam was issuing. This side of Erebus must resemble a gigantic pepper-box !

Inside the hut Day was doing some ingenious turning. His lathe was certainly unique ! Many of the hardwood rollers for the motor sledges needed renewal. So he attached a block of hardwood to the flywheel shaft of the oil-engine, and he sat on the floor and, using a box as a tool-rest, he turned out rollers quite successfully, if not very rapidly.

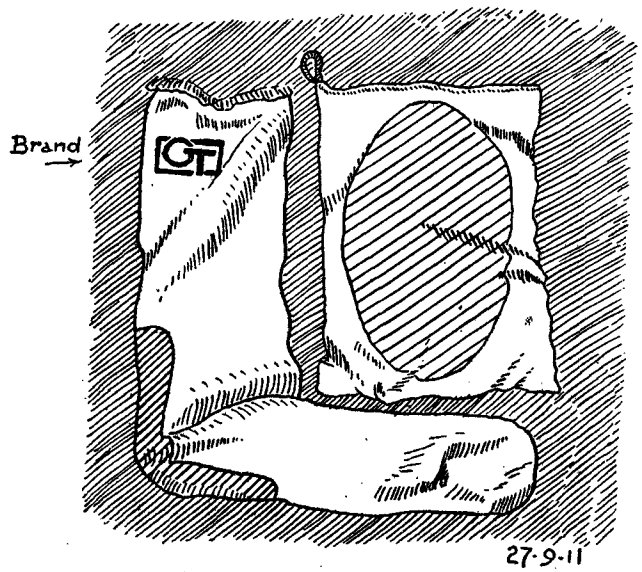
The morning of the 24th was quite clear, so I got my camera into working order, only to find the sky clouding over for a blizzard so soon as I ventured out, about noon. Ponting was lost for about two hours in the thick fog in the evening. We fired off guns, and it looked as if Atkinson's mishap was to be repeated. However, luckily he had a compass, and so got back to the hut quite safely in the end.

The weather was hopeless, and the coast survey party very sensibly returned to await better conditions. The following scurrilous rhyme pinned to Gran's diary affected them not a whit :—

"Three bold explorers hied them forth
For to explore the plain;
Although so bold,
They found it cold,
So hied them home again!"

Next day was again gloomy and cold. It took me ten minutes to rub the sunshine ball clean. The record for yesterday showed clearly the sudden cessation of sunshine about noon, just when I was ready to use my camera.

Every one was now busy with sledging outfit. Bernard



My contribution to Polar Clothing!
"Taylor's Patent Heel-tips"

Day and Cherry each gave me thin gloves for my forthcoming theodolite work; Hooper washed some of my clothes, and kindly sewed a huge pocket on the jersey. One great improvement was to my socks. I sewed canvas heel-tips to most of them, cut out of my specimen bags, of which I had more than I required.

Clissold had boiled Oates' famous home-made canvas breeches, and scrubbed blubber out of them for an hour.

He donned them with joy, and they now hung in graceful folds in place of being as stiff as stove-piping. Every one laughed when he was caught solemnly dancing to the pianola in them!

The one great lack on our previous journey had been strong soles to our boots. "Titus electrified us by saying that he had a stock of hobnails. I offered him five pairs of socks for them, or anything he liked. He enjoyed this hugely, and finally said, 'Well, I'm interested in a military magazine. If you'll write a five-page article on "Physiography for Soldiers," you can have them!' I agreed willingly; but my visions of a boxful were unfulfilled. There were barely enough for two soles.

"The western trippers returned early on the 29th. They had finished up with a stiff day, doing twenty miles in very bad weather. They had got across in two days and four hours. The depôt on Butter Point was invisible, bar one tin! No staff or flag. They dumped our two cases on top. (Birdie counsels taking an extra tank for biscuits.) The Owner thinks the south tongue of the Ferrar is due to a tributary glacier, but they didn't go near it. Then up to the Cathedral Rocks. Here they found an apparent movement of a foot in C. S. W.'s stakes. Of course the glacier *must move* to keep the end of the tongue stationary (*i.e.* ablation replaced), but this is an important amount of corroboration. Then they returned and coasted round to Dry Valley. There is a huge icefoot here, probably preserved by the sheltered position of these cliffs. They climbed up the Kukri Hills near where Evans and I put Station I., and saw the Taylor Glacier, etc., quite well. Then across to Cape Bernacchi. Here they got some kenyte and were much bucked, but we also got much of it further west in Dry Valley. They marched about twenty miles north and saw a huge berg. This had a stake on it, and 'B. A. E. Expedition' on a board. They found it was our glacier tongue, which had drifted across to this position, about seventy miles to the north-west! Beyond was Dunlop Island, sixty feet high and half a mile long. Many rolled pebbles on it and raised beaches. The Owner got a good specimen of granite, showing rounded erosion above and angular below, where it was bedded in the beach.

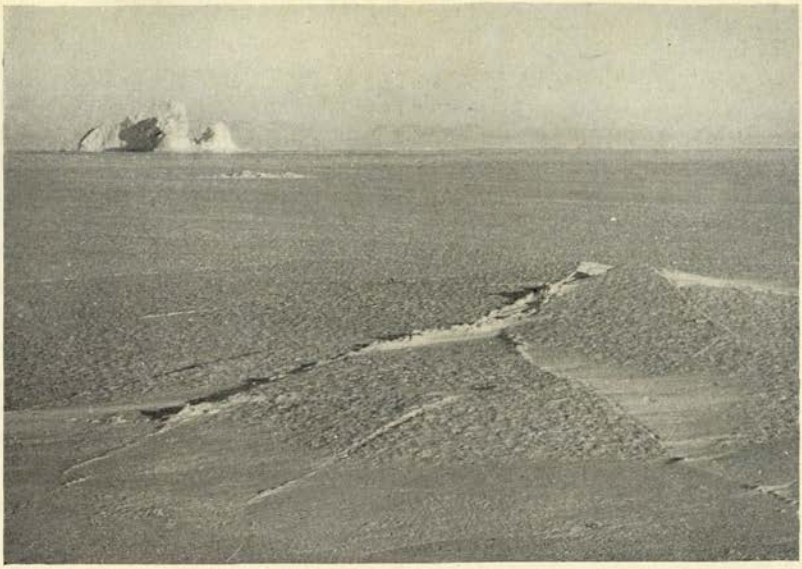
"Near here there was a cliff of schist-limestone with quartz

veins, and here the Owner got a strong vein of copper pyrites. The adjacent limestone (or marble) they thought was quartz. This has a blackish mineral in it, perhaps copper glance. Then they returned to Marble Point and then in a beeline to the Hut. They were caught two days in a blizzard and had an awful time getting up the tent. Sunny Jim was nearly frostbitten holding up the poles.

"The Owner didn't think we could retreat over the shore, for it consisted of ice slopes with crevasses. But there are so many bergs there that he was sure that an ice margin would form there quickly; and he thought we could count on reaching Hut Point by April 1 . . ." (As will be seen later, the sea-ice broke up quite abnormally; and we should not have got round till next spring if we had not retreated in February over the ice slopes. Atkinson tried this journey in April, just as Scott suggested, and found it impossible! which is but one more illustration of the irrationality of Antarctic conditions.)

Now that the sun was back again, it was very enjoyable to tramp round our headquarters and "snap" pictures with the camera. I realized more than ever that a geologist is *always* in a position to enjoy nature. In civilized regions a botanist may run him close, but down south the former would have a poor time, whereas there are always rocks or ice, even in Antarctica. The snow ridges were most beautiful objects, all lying on the northern (lee) side of various projections. For instance, a great promontory of snow jutted out over the sea-ice from the Northern Glacieret, and clearly marked the origin of the latter, as consolidated snowdrift. A little further the sea-ice at low tide, evidently bumped on to a great boulder, and the ice was cracked and bent into a low dome, exactly as a granite boss is supposed by geologists to crack the earth's crust. Beyond this the snow cornice due to blizzard drift was busy bridging the tide-crack, and this accretion from one side, gradually extending to the other, led to a theory of crevasse-bridges, which explains the greater thickness in the centre of such bridges.

The sculpturing of the kenyte boulders was most remarkable. Just behind the hut was a quaint boulder, carved by wind and frost into something resembling a Galapagos turtle! This we called the Antarcticosaurus. On the Ramp



ICE-QUAKES IN THE SEA-ICE, SEPT. 23, 1911.

The ice has settled down with the tide on a huge boulder and so formed radiating cracks, just as has happened in the earth's crust. The ice is six feet thick. In the distance is the fallen "Arch Berg" just west of Cape Evans.

THE TIDE-CRACK AT THE NORTH-WEST CORNER OF CAPE EVANS, SEPT. 23, 1911.

On the right is the moving sea-ice, on the left the fixed ice-foot. The blizzard "bridges" the crack by cornices built from the south. The overhanging snow fills crevasses similarly, and thus arises the wedge shape of the bridges—for these cornices are thickest in the middle. Behind is Inaccessible Island with its wind-blown sand ridges on the right.

to the east of this was another block shaped like the power-shears used in machine shops for cutting iron plate. In the same region were great blocks several feet across split clean in half by the action of the frost.

Small lakes, debris cones in all stages, solifluction furrows, ice dams, kenyte columns, wind-ridges, etc., etc., there was no end to the intesting photos one could obtain now the sun was with us again. Still it took a long time for him to illuminate the southern cliffs of the Cape, for he would dip behind the mountains to the west for several weeks to come, quite early in the afternoon.

On the 29th of September I tramped across to Tent Island, which lay four miles south of Cape Evans. The island was approximately square and about 800 yards along each side. The west side was fairly steep and the island sloped gradually thence to the east. At the south was a well-marked ice-foot, just like the one on which we camped in the blizzard on Little Razorback. It is probably due to spray and snow blown on to the windward face by the southern blizzards.

There were a number of small water-cut gullies furrowing the slopes. The surface was quite peculiar. The kenyte gravel was so small and uniform that it looked like a well-raked garden, and was like velvet to walk on! I found a few small granite erratics, just as Oates had prophesied. The latter had visited the isle a few days earlier, and was delighted to hear that Debenham had missed the granite boulders which Titus had seen! The geologist had been handicapped by a bad light and some snowfall; but it may readily be imagined how little that affected the cavalryman's pride in his discovery!

The evidence of water erosion in the Antarctic was important. One gully was quite 25 feet deep with a steep grade and was about 30 yards wide. It ended in a fan which spread out over the ice-foot. I could not climb down the latter, and so reached the sea-ice where I had climbed up, further to the north.

I had a long talk with the Owner about my plans for the forthcoming summer. He was much averse to our trying to return by the Piedmont Glacier, probably because of the greatly increased risk of falling into crevasses if your path lies *along*

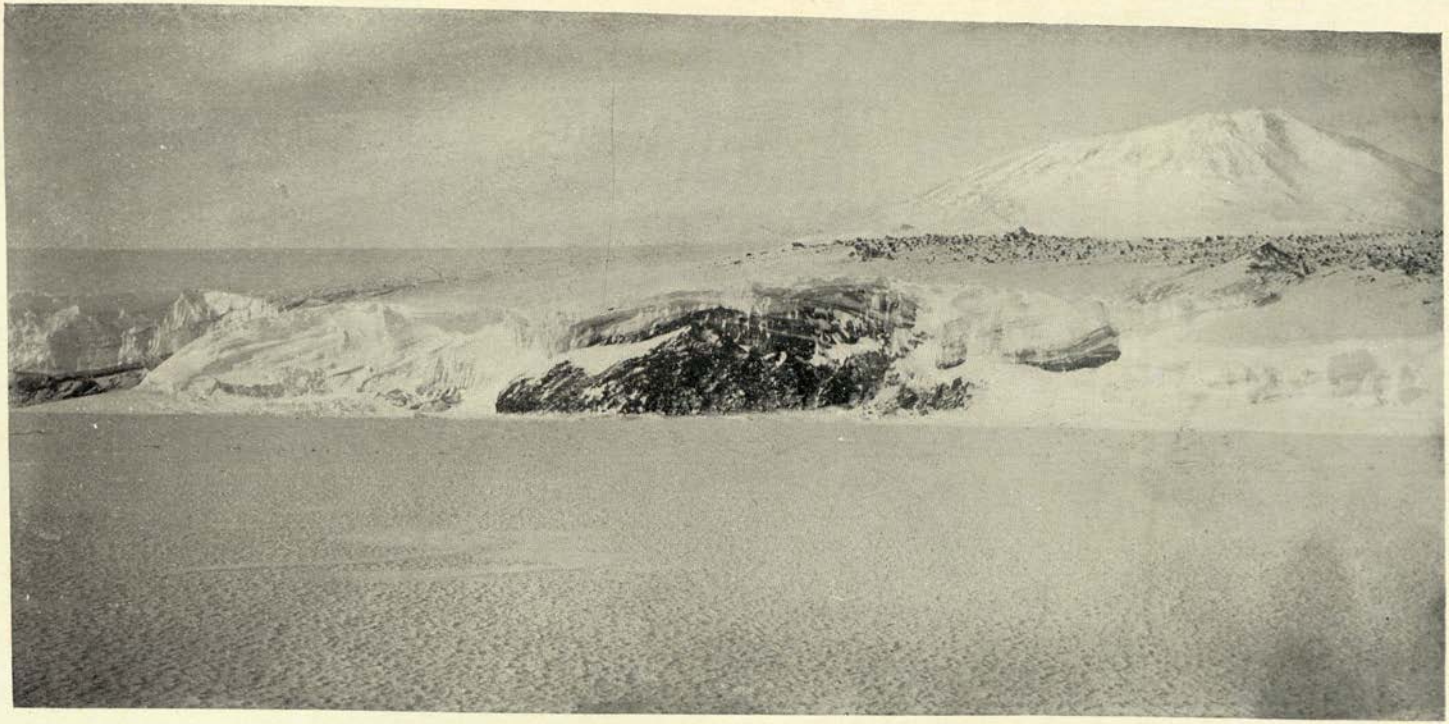
their length (instead of across them, as in traversing ordinary outlet glaciers). I think our party were the first to do any considerable distance over such a glacier, and I must confess that I would infinitely prefer to ascend a *normal* glacier for twice the distance.

In one important respect the environment of our hut was scientifically more interesting than that of 1902 or 1907. We were only a few minutes' walk from the huge face of an important glacier. This meant that many hours could be spent studying ice conditions, without being at a dangerous distance from safety if a blizzard suddenly sprang up. Almost every day Wright and myself prowled around High Cliff and the vertical 150-foot face of the Barne Glacier.

As one walked north from the cape on to the sea-ice, the ice-covered slopes of the Ramp (which we called Slippery Slopes) merged into the ice of the Barne glacier. Just at the northern "root" of Cape Evans was Low Cliff, a mass of kenyte *in situ*. Further north every few hundred yards was a permanent snow ramp leading up to the glacier surface 100 feet above. At High Cliff an outcrop of kenyte was exposed below the ice mass, and a little further north was another lower outcrop at sea-level. Between these two—and about a mile from the hut—Gran worked hard to convert a snow slope into a suitable ski-run. It looked a ferocious jump to the tyro, and ended in a jumble of sea-ice blocks which usually upset even our champion ski-er! (*I* did not tackle this particular spot, having a desire to keep sound limbs for the ensuing summer, but nothing ever harmed Gran, as far as we could see!)

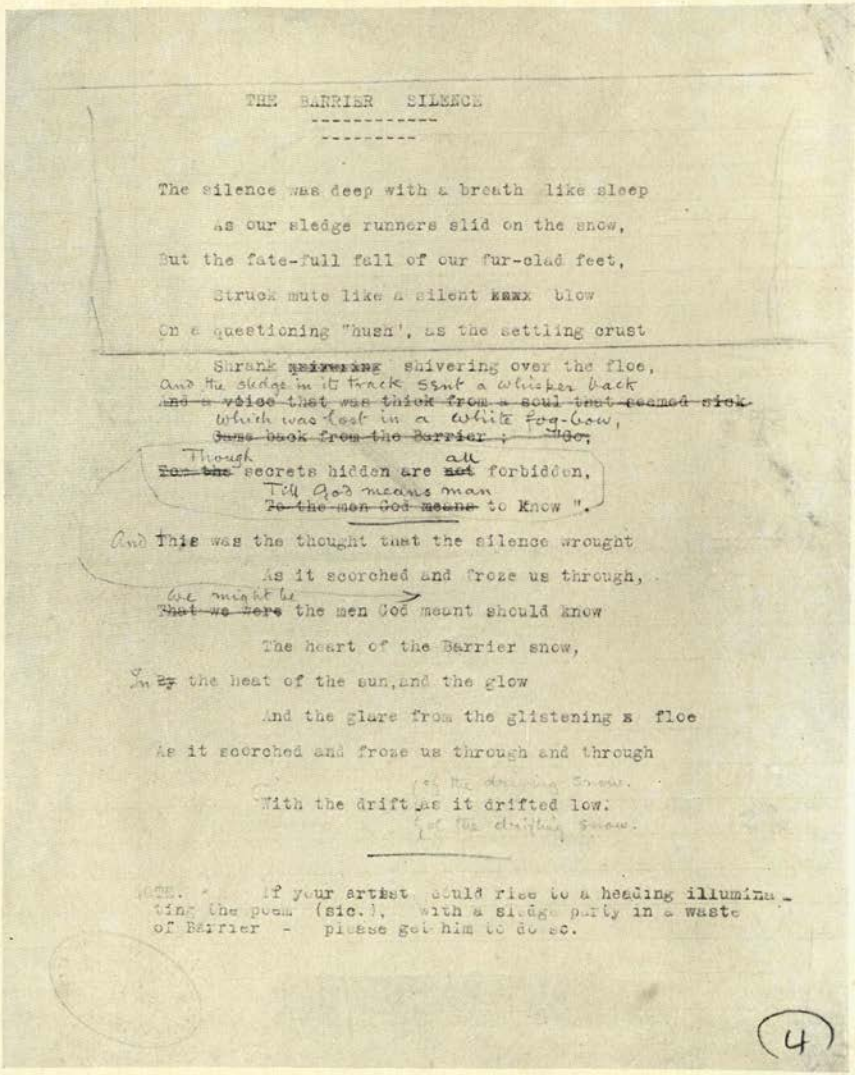
A stiff pull up the ski-slope brought one to the top of the glacier. Here the edge of the latter was closely corrugated by small thaw streams, while the sun had etched out the face of the ice and left great blocks of englacial kenyte projecting like the gargoyles of Notre Dame. The silt bands and texture of the glacier hereabouts, which was unusually rich in included debris, are well shown in the accompanying photographs.

The last volume of *S.P.T.* for 1911 was now in preparation. The editor honoured me with an order for another skit on the lines of the Bipe research. So I wrote a second dealing with sledging trials, purporting to be love-letters



HIGH CLIFF AND THE SOUTH END OF THE BARNE GLACIER, OCT. 21, 1911.

Ski Slope leads up to the glacier on the left. The debris cones show up well on the right. The banded nature of the glacier ice shows clearly to the right of High Cliff. The glacier and cliff are here about 120 feet high. Erebus is 12 miles off.



THE BARRIER SILENCE

The silence was deep with a breath like sleep
As our sledge runners slid on the snow,
But the fate-full fall of our fur-clad feet,
Struck mute like a silent ~~xxxx~~ blow
On a questioning "hush', as the settling crust
Shrank ~~quivering~~ shivering over the floe,
And the sledge in its track sent a whisper back
~~And a voice that was thick from a soul that seemed sick~~
Which was lost in a white fog-bow,
~~Came back from the Barrier ; "Go,~~
Though ~~For the~~ secrets hidden are ~~not~~ all forbidden,
Till God means man
~~To the men God means~~ to know ".

And This was the thought that the silence wrought
As it scorched and froze us through,
We might be ~~That we were~~ the men God meant should know
The heart of the Barrier snow,
In ~~By~~ the heat of the sun, and the glow
And the glare from the glistening ~~s~~ floe
As it scorched and froze us through and through
With the drift of the drifting snow. as it drifted low.

NOTE. If your artist could rise to a heading illuminating the poem (sic.), with a sledge party in a waste of Barrier - please get him to do so.

(4)

This is an original copy (reduced) of Bill's poem showing the footnote he added (in imitation of my earlier directions). Also showing his corrections after Cherry's criticism, thus giving the poem in its first and also its final form.

between a McCormick Skua and a Weddell Seal. This was illustrated in similar style by Uncle Bill.

One day when I was typing this copy on Cherry's typewriter, Bill came to me with a poem he had written. He asked me to type it so that Cherry should not recognize his writing. He wanted it to be perfectly anonymous, for he knew anything of Bill's would go in from our admiration of the writer! I saw that he had copied my footnote (so as to puzzle Cherry further) asking that an illustration be appended by the artist on the staff!

(This poem is that forming the introduction to the second volume of Scott's Last Expedition.) A few days later Cherry brought me all the MS. and was graciously pleased to compliment me on the lot—especially the poem "Barrier Silence"! So I had to disclaim authorship—in spite of the footnote. After some time I think he believed me, but he wanted two lines cleared up a little and asked me to do it. I declined to alter it, but said that evidently the author expected Bill (as artist) to see the poem, and that I was sure that whatever he and Bill agreed to would satisfy the author! Whereat I heard Bill chuckle, and later it was returned to me emended as shown in the annexed facsimile.

Two explanations are perhaps helpful. The surface of the Barrier over large areas often sinks suddenly to a slight degree when it is disturbed by a sledge party, and this "shudder" has a very eerie sound. The glare from the blinding surface affects the eyes much as does a hot substance, and this is independent of the temperature. Hence the remark, "Scorched and froze us through and through."

Evans, Gran, and Forde had done a rapid and useful dash south to see if the first depôts were in good order. They experienced awfully low temperatures (below −70° !), but managed to dig out the cases at the depôt, and restore them to a more noticeable position. It must have been an awful job, and there was evidence of this after their return. Forde awoke next morning to find three of his fingers black, and one was soon attacked with gangrene! For months his right hand was bound up, and he was unable to use it fully right through our western journey next summer.

The geologists had to be very active, and make the most of the next week or two to study the numerous problems

confronting us in the vicinity of Cape Evans. The sunlight made it possible to go longer distances, and I examined Inaccessible Island, Turk's Head, Tent Island, Glacier Tongue, and Cape Royds in greater detail than I had been able to do before. Thus on the 4th October I tramped six miles south to join the survey party at Turk's Head.

Captain Scott had brought down a bicycle—given by a New Zealand firm—on representations from Day and myself. I had ridden many miles over snow in France, and thought it would be useful for short trips round headquarters on the sea ice. I got it out this day, but could not find the pump, and so did not use the bicycle.

I reached Turk's Head about noon, and found the survey tent; but the party were four hundred feet up on top of Turk's Head. I could just see Debenham on the summit, and got a photograph with his figure on the sky-line.

It was tolerably easy to climb up the north-east gully, and so attain the cup-shaped hollow on the summit, which enclosed a small frozen tarn. Wonderful crags bounded the Bluff to the south. Great pinnacles and couloirs etched out of the basic lava cliffs, due to the biting breath of the southern blizzard. At the head of the bay, to the north, were steep ice-falls. These moulded themselves round slender jagged pinnacles of rock, which one would expect to have been eroded with great ease by almost any type of glacier.

We marched back to the survey tent in a cove two miles north, and ate the currant cake which I had provided for lunch. Great ice-falls came into the cove, and a huge cave was formed where they shot over the cliff. It was thirty feet high, and went a long way into the glacier. The sea-ice near the tent was ridged into pressure waves eight feet high by the thrust of this glacier. I heard that they had altered in shape while the party had been there. It was amazing to me to find so little trace of polishing or planation under this huge glacier. We returned close to another low outcrop called the "Slipper," and closely examined it. There was practically no sign of glacial action on the rock surface just below the ice. Of course kenyte is somewhat friable, and we occasionally found coarse bruised grooves marked on the side of a boulder, but never any definite striæ or polishing.

Perhaps the most interesting event of the day was that we

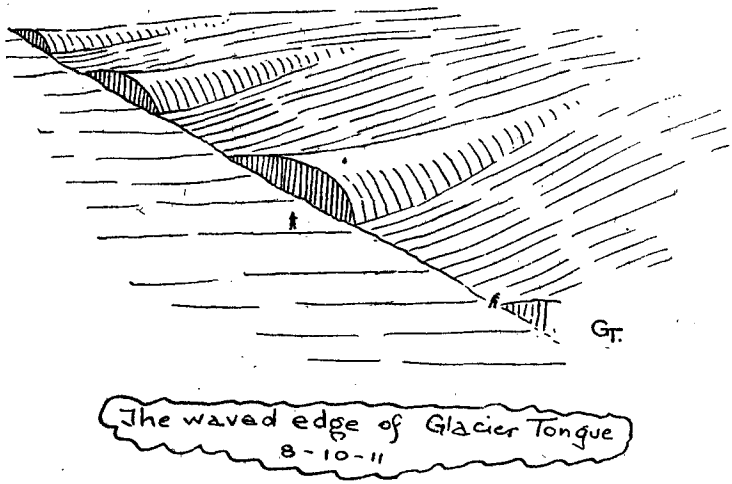
heard a mysterious tinkle in the corner of the hut. This was Meares ringing up headquarters from the Old Discovery Hut some fifteen miles south! He took a roll of bare aluminum wire on the dog sledge, and just unrolled it as he sped off to Hut Point—surely the most primitive and simplest method of telephone-laying extant! I rang him up and asked him to keep a look-out for my geological hammer, and then proceeded to beat Wright at chess.

On the 8th I had a very unpleasant experience, largely owing to my own foolhardiness. I obtained permission from Captain Scott to go off to Turk's Head, and said I hoped to be back by 4 p.m. He said, "Well, you must return by dinner-time." It was a fine, clear day; I had found the bicycle pump, and was keen to make some use of the bicycle. I set off boldly "to the admiration of those engaged in mending the tide gauge. But it went stiffly, even through fairly hard snow, and I realised it was not going to be much of a help. I had to walk half of the first two miles, and seriously thought of leaving the bicycle at east base, but hoped that the surface would improve. It was so hard that my boots hardly sank in the snow, but the wheels cut a two-inch rut, while the freewheel was of the roller type, and slipped when I put on extra pressure. I pushed on to Glacier Tongue and had to walk half the eight miles, and found it very tiring."

The tongue was most interesting. In outline it somewhat resembled an Aztec sword, where jagged bits of obsidian are inserted fairly close together along the edge. Here the ice edge consisted of alternate promontories and bays—owing to the sea-water occupying the troughs of the undulating glacier. I thankfully left the bicycle here, and climbed into the tongue. I was very stiff, and had apparently strained my leg with unwonted exercise.

There seemed to be a very interesting cliff outcrop at the northern root of the tongue, and I decided to visit it. It looked about half a mile off, but the deceptive distances proved my undoing. After a rapid walk of half an hour I only arrived at the outer zone of pressure ice at the head of the bay. I could see that it was an interesting spot—where the glacier capped a rock outcrop—but I dared not go further. So I turned back, and was pretty done up when I reached the

bicycle again. It was now 3.30, and I had had nothing to eat since 8.30, and had still seven miles to do. I rested for a few minutes and then began to feel anxious, for I got very cold. So I plugged on a mile or so till I couldn't walk any further, and had to rest again. This time I felt myself chilling rapidly, and was in a quandary. I was too knocked up to walk, and it was too cold for me to stop. "Then I saw some one trying to climb up Turk's Head about two miles away. I couldn't make him hear, and pushed on to try and intercept his return. I didn't get a return signal for an awful time, till he was just passing me. It was Wright, without his glasses. He hadn't heard me at first, but was finally attracted by the motions of



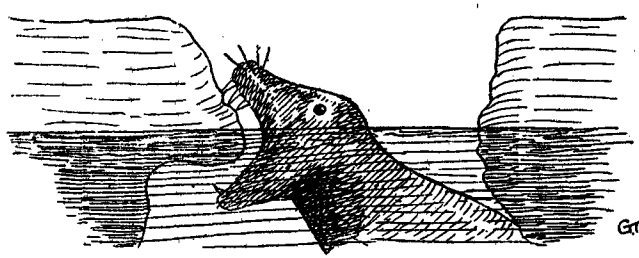
an apparently crazy seal!" We plodded on slowly and got within a mile of the hut when I knocked out completely. He pushed on to bring out a sledge, and found the hut in a state of excitement; for Clissold had been brought in nearly unconscious only a short time before.

After a short rest I managed to reach the hut unassisted, and food and sleep made me practically all right. Poor Clissold had fallen thirty feet off an iceberg, and was confined to his bunk for several weeks in consequence.

I made a vow that the first bicycle ride in the Antarctic should be *my* last, and have every intention of keeping that vow.

On the 11th Debenham and I explored Tent Island again.

As I was taking a photograph at the south-east corner, I heard a queer noise which I traced to a seal hole about a yard long. Inside this was a big seal trying to get out, but with little success. I thought at first he was trying to rub away the ice with his snout bristles, but he was really rasping right and left with his upper teeth—making horizontal grooves in the ice, and gradually wearing it away. We watched him for a long time from a few feet distance, which did not seem to



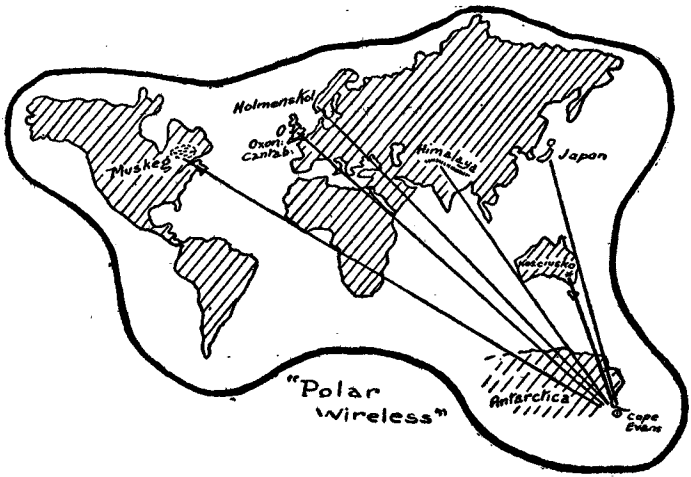
The Seal's method of rasping away the Ice
11-10-11

worry him at all. It made my teeth ache to see the energetic way he dug into the ice; but after trying unsuccessfully to photo him I left without seeing that he had made much progress. These seals were now appearing in some numbers. We counted fourteen near Tent Island, and eight just north of Inaccessible Island, as we returned to the hut.

On Sunday, 15th September, the third volume of *S.P.T.* was published. It was in the same style as the preceding copies. There was a dramatic account in blank verse of the *Terra Nova's* visit to South Trinidad, which I attributed to Nelson (but was really by Mather). Meares wrote an ode to Ponting in which my new word "to pont" (*i.e.* to spend a deuce of a time posing in an uncomfortable position for a photograph) was freely used. The Eastern Party was enshrined in a "Glass House" this time, while Bill recorded on his Egyptian tablets the wanderings of the Western trippers during September.

Bill's illustrations to "The Ladies' Page," a record of Antarctic fashions, were some of the best he had done; especially Madame Bowers and Miss Jessie Debenham, coyly proposing to Titus Oates!

I have given the history of Wilson's pathetic poem previously. We used to talk a good deal about the advantages of "wireless," and I tried to embody the idea in a poem of sorts, which here follows, in which are mentioned scenes familiar to various members, such as Oxford (Cherry); Cambridge (Wilson, Wright, Nelson, Taylor); Ski-ing in Norway (Gran); the Canadian muskeg (Wright); Australian Alps (Debenham, Taylor); Japan (Ponting, Meares); India (Simpson, Oates, Bowers).



I.

When the southern blizzard surges from the white plains of the Barrier,
Covering all with deadly snow-wreaths, blotting out both land and sea:
Can it break the magic cables linking us to every region
Where we spent our days of study, days of youth and revelry?
Half the world is our possession, nought can curb imagination,
Though we're wrapped in folds of deerskin, camped amid a field of ice,
By the blessed help of fancy, still we're free to wander gaily
Through the wooded lanes of England—true explorer's paradise.

II.

By the happy help of fancy we can leave the land of glaciers,
Hear the tolling from Tom Tower, or the chimes from Cambridge arches,
Sense the thrill of ski-ers' prowess on the slopes of Holmens Kol;
Once again can feel the tump-line as we cross the Muskeg Marshes;
We can change the Slopes of Terror to the sward of Kosciusko,
Where a thousand steers are grazing 'mid the tarns and green moraines;
See the land of Cherry Blossom and the maidens of Japan,
Or the peaks of Himalaya hung above the Indian plains.

III.

Lightly fades the lonely igloo; merges in the college gray . . .
In the firesides of Old England, thirteen thousand miles away.
Thus from Lonelands to the Homelands all our thoughts are speeding forth,
Faster far than wire or wireless—on "stretched wings towards the north." *

Cape Evans, 27.10.11.

I had an interesting midnight walk early on the 15th October. "I had no gloves on, and it was light enough to photograph. There was a beautiful red sunset due south. To the north the bay ice was pea-green, while Erebus shone out with purple shadows. I laid boundary stones at the ice margins of both Skua and Island lakes, to determine how quickly the ice ablated in the spring. That evening I caused a sensation by having a shave, the first since leaving New Zealand. Birdie, Simpson, and Cherry behaved most foolishly as a result. Day did the deed!"

We found the Hut Point telephone useful for weather forecasting. For instance, on the 16th Meares rang up at 11 a.m. to say that it was blizzing (with force 9) from the south with a temperature of −16° F. At this time, though only fifteen miles away, we were experiencing a moderate north wind (force 3) with a temperature of −3° F. "As a result Titus bet Teddy Evans that the blizzard would arrive before noon. The wager was six cigarettes. No blizzard arrived at all, so that Teddy won, but as he had given up smoking for some months he only took one for Debenham!"

On the 17th Debenham and I went over to Shackleton's

* Scott's motto was, "Stretched Wings towards the South."

hut to spend a few days geologizing. We took a small sledge with about 100 lbs. load. Soon we came to patches of bare sea-ice just leprous with blobs of salty snow. I was chagrined to find we could hardly drag our light sledge across. It augured badly for the 1200 lbs. we should have to pull in a week or so! We saw Emperor penguin tracks, but no birds, and reached the hut at 1 p.m. We ate some biscuits and then went out to photograph the vicinity. Here the Erebus glacier is about three miles to the east, so that Cape Royds is a very much larger area of exposed rock than Cape Evans. We walked along Black Sand Beach—almost the only beach I saw with rolled pebbles—and passed below quite a large glacier emerging from a gully. It had a 30-foot face of banded ice with fine snow cornices. I was surprised to see this, and climbed up to determine what was its source of supply. Then I found it was "all face" and no background. It was in fact merely a gigantic snowdrift plastered on the face of a 50-foot rock-cliff, and proved that many of our smaller glaciers were nothing but case-hardened snowdrifts which had solidified *in situ*.

We returned to Shackleton's hut, and I had a varied lunch off mock turtle soup, mutton cutlets, and unlimited candied peel! We cleared up the hut, which was in an awful mess, Deb arranging the stores and mending the stove, while I swept up the floor.

"We made up a bit of fire with some coal we found in one corner and turned into our bags. All next day it blew frightfully hard. There was a huge iron boiler which we gradually thawed out and used for water, but we used an enamel jug as a kettle. We made porridge and ate it from huge wooden spoons. I read 'The Truants' (Mason) and half the 'Botor Chaperon' (Williamson). The hut groaned and creaked so that I thought it would blow in sunder, but we were comfortable enough. We hunted up some hypo, a large lamp, and 50 lbs. of carbide. I found a useable pair of fingered gloves, which were just what I wanted for instrument work."

Next morning it was blowing hard, but there was less drift. We went out to try a photo, and the blizzard blew my camera down and smashed the frame. After lunch it "let up" somewhat, and we set off for Cape Evans. We saw an

Emperor penguin crouched behind a snow-drift. It was the first of the season, and Debenham was anxious to get a photo. He stalked the penguin with great care, to my secret glee, for I had noticed before that it was stone dead!

Next day I packed my ditty-bag with personal gear for the summer journey. We were allowed 12 lbs. each. My choice was as follows :—

3 pairs *socks*, with Taylor's patent heel-tips!
1 hat.
1 pair finger gloves.
1 diary, 1 Browning, 1 German grammar.

This totalled 7 lbs., and I decided to omit spare underclothing and take a small eiderdown weighing 4½ lbs. It struck me that it would be as comforting as Debenham's 3 lbs. of tobacco, and last longer!

"In the afternoon we 'ponted' for a game of football for the cinematograph. It was awfully good fun. The Owner was centre forward (running to the north), and he arranged that his side should win, to ensure an exciting picture! Atkinson was given space for a fine run in. Unfortunately in trying to cleverly miss a collar I slipped, and he fell over my feet. Titus was a sight, waddling after a man and then falling flat. Half the people got confused with the Owner's yells to 'Keep the ball in the middle and up to the goal,' so that many of our side kicked it to their own goal! Crean truculently swore no one should get a goal if he could help it, and spoilt all Atkinson's efforts, so that they scored nothing! Unfortunately Debenham strained his knee defending goal, and has been on his back since. We shall start west with Forde's right arm useless and Debenham's leg crocked!"

On the 21st Scott gave me my sledging orders. The method of our relief by the ship seemed rather comic. We were first of all to find Granite Harbour and then recognize a 500-foot bluff, photographed on page 154 in "The Voyage of the *Discovery*." Here we were to await Captain Pennell in mid-January. No one on the ship had seen Granite Harbour either. As will be seen later, the harbour was a dozen miles wrong longitude, and the only bluff which at all resembled the picture was 1650 high! We rendezvoused there as required, but our letters and flag on the bluff remain undisturbed to this day!

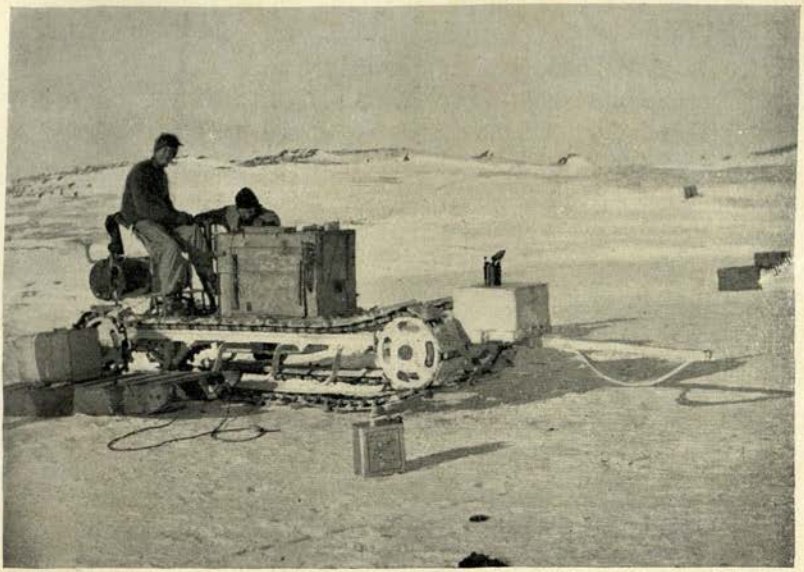
Gran accompanied me for a walk two miles west to the great shear crack, and there we spent some hours with pick and shovel cutting a path through the upturned blocks of sea-ice, here 5 feet high.

Day started the motor sledges on the 23rd October. The motor party consisted of Evans and Lashley with one motor sledge, and Day and Hooper with the other. There was a fearful array of cameras carried by Scott, Gran, Wright, and myself, while Ponting had a regular battery (including a cinematograph) loaded on his "pantechnicon"! Two troubles hampered the motors. The "pattens," or wooden soles on the two tractor belts, would not grip the surface unless it consisted of hard snow. Just off the Cape was a belt of smooth sea-ice with a thin layer of snow over it, and the belts churned rapidly over this without moving the sledge forward. They got them past this by laying down sacks, etc. Then the motors were air-cooled, and apparently this was not sufficient to keep the cylinders from overheating, especially as the sledges went much slower than the ordinary motor car, and so only a small current of cold air flowed past the two front cylinders and less past the two rear cylinders. Moreover, the carburettor would not work satisfactorily when the engine was down to Antarctic temperatures, and it was necessary to warm it with a blow lamp! After some delays and readjustments they got the sledges well under weigh to Big Razorback Island.

Nelson, Wright, and I decided to traverse the Barne Glacier (to the north) and align the stakes which Nelson had planted in the preceding February. We hoped to detect enough movement to give us the velocity of the glacier.

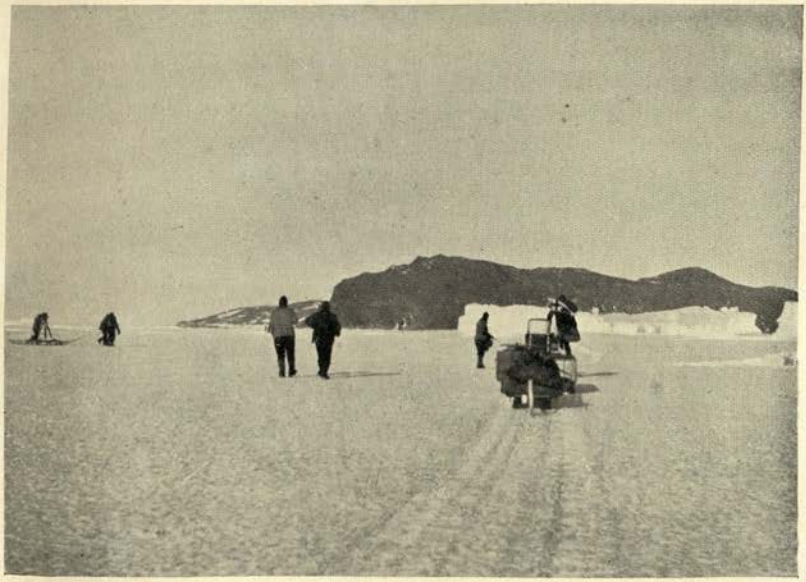
The new canvas overshoes, with spiked aluminium soles, were a godsend for slippery ice work, and we found them a wonderful help. Wright went first, carrying a theodolite; then Nelson, with the food, and I had my camera and an ice-axe. We were roped up, for we had to cross many small crevasses. The stakes were generally made of barrel staves, and only half of them had withstood the winter.

We soon reached the "nail-stake," which showed the safe western route to Shackleton's Hut. The stakes here turned to the north and crossed a wide gully, and then climbed up a steep shoulder with open crevasses, which we had to negotiate



BERNARD DAY ON THE MOTOR SLEDGE JUST BEFORE HE STARTED FOR THE SOUTH, OCT. 23, 1911.

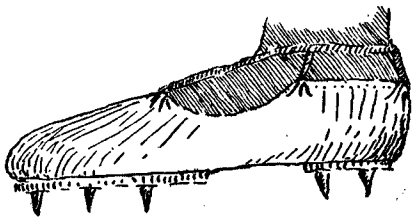
The engine is enclosed in a box to keep it warm, and the blow lamp was to start the carburettor.



THE START OF THE MOTOR SLEDGES, OCT., 1911.

Notice Evans swinging round the sledge and Day's flag. To the left is Ponting being towed as he cinematographs.

by jumping. We reached the fixed moraines, and while Wright set up the theodolite (and anathematized his frozen fingers!) we discussed hot cocoa from a Thermos flask, and biscuits and chocolate. The end stakes did not appear to have moved much, but as we marched back on their line we found very perceptible evidence of movement to the west. Fourteen inches at first, then 7, 12, 14, 15, 15, 22, and 16 feet respectively, till we again reached the "nail-stake." It was rather difficult aligning the stakes, owing to the crevasses, but though some were ten feet wide they were all open and so perfectly obvious and safe. "Nelson slipped in his felt boots, but we could have walked up an ice wall in our new spiked crampons!"



Ice crampons, devised in the winter 1911.

The largest movement was in the ice valley, and though the maximum 22 feet was not certain, yet there was no doubt about the record of 15 feet. This was not nearly so much as recorded elsewhere for other Antarctic glaciers; but it must be remembered that only the ten *coldest* months were involved in this test.

On the 26th Captain Scott took two parties to see if he could assist the motor party, who seemed to be held up near Glacier Tongue. We saw no trace of them till near the Tongue. Here we saw a black object, which, however, turned out to be a seal scratching himself, though I had felt able to recognize a motor and its driver!

We took a long time to catch them, which pleased us greatly, for it meant they were doing better than we had anticipated, but we caught them at Danger Cliffs. "They had just done six miles and were very bucked in consequence."

We were of some assistance in the next few miles. We would drag the three huge trailer-sledges forward so as to relieve the motor-sledge at its first plunge. Then "she'd start with a jerk, Day sitting for the moment in the chair of state and kicking up the floorboard to work the levers. Then she'd stop; then we'd curse. He would light up the petrol lamp round the carburettor to warm her, and try various

alterations to an undercurrent of our fervid remarks. Then she'd go harder than we could walk for seven minutes. We got hot again, and would then have to wait a quarter of an hour, stamping round and freezing off, till she was affable once more."

We slept at the 1902 Hut, and Meares and Bowers gave us a grand seal hoosh next morning, cooked on the greatly improved blubber stove.

"Lashley's motor got under weigh after twenty minutes with the blow lamp on the carburettor, but Day's was mulish. Gran, Evans, and I waited with him." The huge loads dragged were mostly oil and tent gear, but their food-transporting power increases as the fuel load is used up. "However, as the day grew the motor took heart of grace and started, doing half-mile bursts, and at 12.45 we foregathered below the Barrier edge. Lashley would have been up an hour earlier, but he ran out of lubricant." Unfortunately being on different gears they couldn't keep together readily. "I walked up on to the Barrier very near where we crossed the big crack on March 12th. There was a beautiful snow ramp up the twelve feet above the sea-ice.

"At 1 p.m. Day moved on to tackle this. We all pushed behind, though it was not a bit necessary. She went up in great style, though I think most of us had dreaded this test considerably. At 1.5 the first motor stood on the great Barrier. Lashley's then ran up quite easily, and after cheering them we streaked back to the 1902 Hut for lunch. Scott and Wilson ran two miles of the distance; Bowers and I walked on together until Crean and Evans passed us. I joined them, but gave them best ultimately, for they were both powerful pacemakers."

We hit off for Cape Evans after lunch at a hot pace and didn't stop for eight miles, when we had tea off Razorback. "All around us were seals and their young. The latter are longer in proportion, and are lighter in colour and woollier. The mothers make a noise like a dyspeptic sheep, and one big beggar *would* nose around the sledges until the Owner drove her away. Bill went off to get a dead young one he espied, and found it alive, but frozen fast by its umbilical cord! He freed it and left it, but Nelson saw the little idiot frozen again two days later."

On the 28th Wilson examined the three Emperor penguin

eggs obtained at such peril in July. To his delight they showed three different stages in development, and were much more developed than he expected. The embryos were rather long, but very like fledgling sparrows. There were little tufts on the tail already, and their long, flapper-like wings were not a bit bird-like. The shells were very thick and about the diameter of a swan's, but somewhat elongated. They were light buff outside and bluish inside. Bill said only about fifteen shells had been obtained, and no embryos.

Household duties have been somewhat disorganized. I have laid and cleared the tables, while Atkinson has been chief cook. He succeeded splendidly for the most part. "He made excellent coffee; Deb tasted first cup, and nearly died, for it was pure cayenne!"

Erebus gave us a fine demonstration from 9 to 9.30 on the 30th of October. The steam cloud rose like a huge mushroom at first, then was branched like a yew-tree, and ultimately settled down into a huge pall.

On the 31st October the pony parties started. Two weak ponies led by Atkinson and Crean were sent off first at 4.30, and I accompanied them for about a mile. Crean's pony rejoiced in the name of "Jimmy Pig," and he stepped out much better than his fleeter-named mate Jehu. We heard through the telephone of their safe arrival at Hut Point.

Next morning the Southern Party finished their mail, posting it in the packing case on Atkinson's bunk, and then at 11 a.m. the last party were ready for the Pole. They had packed the sledges overnight, and they took 20 lbs. personal baggage. The Owner had asked me what book he should take. He wanted something fairly "filling." I recommended Tyndall's Glaciers—if he wouldn't find it "coolish." He didn't fancy this! So then I said, "Why not take Browning, as I'm doing?" And I believe that he did so.

Wright's pony was the first harnessed to its sledge. "Chinaman" is Jehu's rival for last place, and as some compensation is easy to harness. Seaman Evans led "Snatcher," who used to rush ahead and take the lead as soon as he was harnessed. Cherry had "Michael," a steady goer, and Wilson led "Nobby"—the pony rescued from the killer whales in March. Scott led out "Snippets" to the sledges, and harnessed him to the foremost, with little Anton's help—only it

turned out to be Bowers' sledge! However he transferred in a few minutes and marched off rapidly to the south. "'Christopher,' as usual, behaved like a demon. First they had to trice his front leg up tight under his shoulder, then it took five minutes to throw him. The sledge was brought up and he was harnessed in while his head was held down on the floe. Finally he rose up, still on three legs, and started off galloping as well as he was able. After several violent kicks his foreleg was released, and after more watch-spring flicks with his hind legs he set off fairly steadily. Titus can't stop him when once he has started, and will have to do the fifteen miles in one lap probably!"

Dear old Titus—that was my last memory of him. Imperturbable as ever; never hasty, never angry, but soothing that vicious animal, and determined to get the best out of most unpromising material in his endeavour to do his simple duty.

Bowers was last to leave. His pony, Victor, nervous but not vicious, was soon in the traces. I ran to the end of the Cape and watched the little cavalcade—already strung out into remote units—rapidly fade into the lonely white waste to southward.

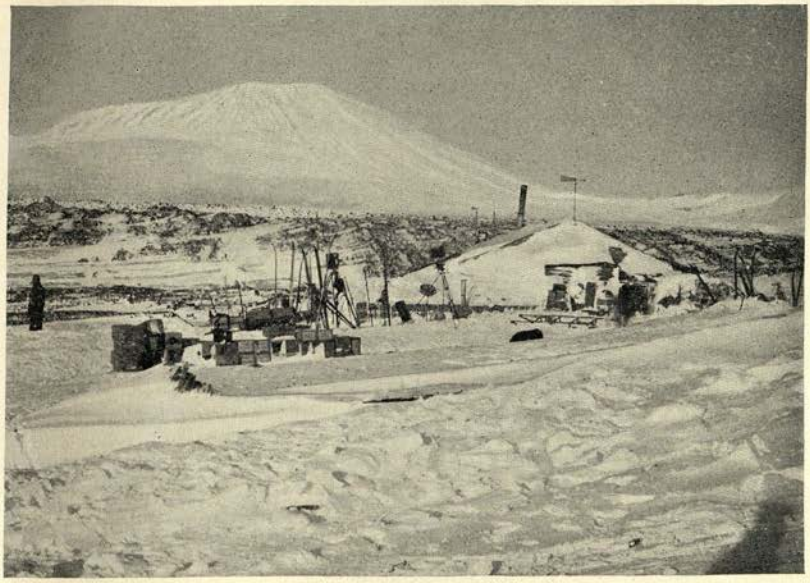
That evening I had a chat with Wilson over the telephone from the Discovery Hut—my last communication with those five gallant spirits.

We settled down in the Hut, a small and rather silent party. I was now awaiting Debenham's recovery from the injury to his knee, for our start was already overdue. Nelson was cook, though Clissold was beginning to move about more easily. As lately, I continued to lay and clear the table, while Simpson was coal-whacker. The night-watch was now unnecessary—it was too light for auroræ—and the ponies no longer inhabited the stable. Nelson used to take the 4 a.m. observations, and Simpson those at midnight.

On the 2nd of November we had some stove trials in the deserted stables. Day's last work had been to make us a blubber stove from sheet-iron, with a door grid and cover complete. We lengthened the chimney (by adding asparagus tins) and then tested it. The cooker was filled with snow, a "fid" of blubber lit on the grid, and in twenty-seven minutes the water was boiling! There was very little smoke, and it

WILSON PACKING HIS PONY SLEDGE THE DAY BEFORE THE START FOR THE POLE, Oct. 31, 1911.

The tins of oil, Alpine rope, large biscuit tins, sleeping-bag and tent poles show up well. Behind is the outer door of the hut looking north to the Barne Glacier.



THE HUT AFTER THE WINTER, Nov. 20, 1911.

Great snowdrifts cover the porch and all the gravel before the hut. At the back is the Ramp, and low level stratus is enveloping the base of Erebus. [See p. 320.

gave a pleasant heat all the time. Later we found that it did not work so well in a draught, and was a trouble in the open; but we cooked most of our meals on it in December and January, as will appear.

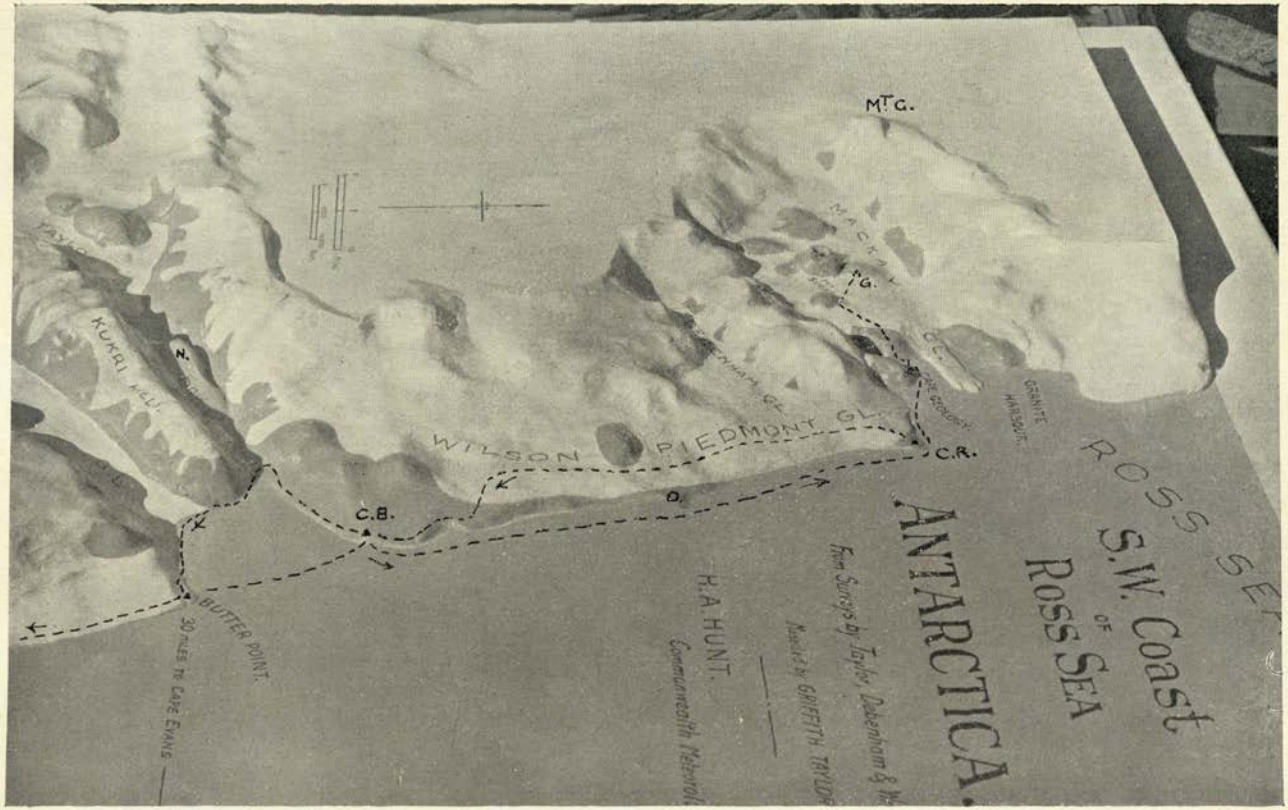
That evening I had a walk round High Cliff and found a regular "Niagara" rushing down the face of the glacier in a tinkling stream as much as an inch deep! This was at midnight on the 2nd of November, and the temperature was seventeen degrees below freezing! It shows the strong radiant effect of the sun on black rocks even at midnight.

This event—marking the oncoming of reasonable weather—closed our sojourn at winter quarters during 1911.

THE GRANITE HARBOUR EXPEDITION

SECOND WESTERN EXPEDITION

NOVEMBER 1911—FEBRUARY 1912



RELIEF MODEL OF THE REGION TRAVERSED IN THE SECOND SUMMER.

C.B. = Cape Bernacchi.
Mt. G. = Mount Gran.
G. = Gondola Ridge.
C.R. = Cape Roberts.
D. = Cape Dunlop.
N. = Nussbaum Riegel (across Taylor Valley).

THE GRANITE HARBOUR EXPEDITION

(*Vide* large folding map at end.)

DURING the winter the four members of the western party often used to gaze to the north-west across McMurdo Sound and wonder what adventures we should meet in the coming summer. We could make out the hills behind Cape Bernacchi fairly well, some fifty miles off; but beyond that was a greyish mass of land which, north of our horizon, was broken by the large inlet of Granite Harbour just about latitude 77°. We read up what little was known of it, and Wilson told us his memories—of a sort of bluff-ended peninsula where we could reach *terra firma*, of ice-falls filled with crevasses, and not very promising as a route to the interior.

We expected to get away by October 22nd, but Debenham, as has been told, injured his knee a day or two before, and spent most of the next three weeks in his bunk trying to reduce the inflammation sufficiently for him to walk.

The western party were unfortunate in having another cripple. Forde's right hand was still in bandages from his severe frostbites, but they were progressing favourably, and though he never was able to use it for delicate operations, it did not handicap him greatly.

On the 5th of November we packed the sledges. Our delay had one advantage—we needed less food, and so our load was lighter. In fact, I don't know how we could have managed much more than our "half ton." I omitted three weeks' supplies, but packed all the remainder on to the sledges. In the huge canvas bag—called a tank by the seamen—were put the weekly bags of stores. Here a little pile of butter, there smaller bags of tea, etc. A few small bags of pepper, salt, etc., were placed in the "Ready-Bag." This latter was a smaller canvas bag which held just a week's food, and was kept separate from the main "tank," so that

the latter was only opened once a week when the cooks changed duty.

A document which was consulted more frequently than any other which we carried was Bowers' list of our stores. It was headed, in a last flash of his humorous verbosity, "The Western PHYSIPHOGEOPETROVULCANOLOGICAL PARTY," and gave me careful notes as to the stores at Butter Point, and tips as to taking tin-openers, and bags for the cocoa and pemmican tins we should find there. It got very frayed with continual use, and this led to some anxiety later. All the items were entered like this :—

"Biscuit for 20 weeks at 24·5 lbs. = 490 lbs." The entry for *tea* I read as—

"Tea for 20 weeks at 1·75 lbs.," but it was nearly illegible, and later, after wondering why the tea was so rapidly diminishing, I saw that his note really read 1·75 *for ten days* (instead of "per week"). This was one of the most welcome discoveries on our journey, for I thought I had lost some bags of the precious beverage, and we soon evened matters by greater economy.

On the Sunday afternoon (5th November) Gran, Forde, and I pulled the big sledge over the sea-ice to the west. We had very heavy work dragging it over the snow near Cape Evans, but owing to the track we had cut through the walls at the great shear crack we crossed this quite easily. We came on some mirror ice, where the runners positively flew along, but a film of snowdrift about a quarter of an inch deep made us nearly lie down in our traces. We took the sledge about three miles out and then returned to the hut. *En route* our collie bitch worried a seal almost to death, and though Gran gave her a tremendous beating, I doubt if that even made the dogs refrain from tormenting the helpless animals.

Perhaps they felt that the seals were fair game, as they were so much bigger than themselves!

On Monday a blizzard came up, in which superstitious little Anton had a wild time reaching the hut. He had left Ponting encamped at Little Razorback, and much preferred to find his way back, rather than spend a night among the howling demons of the Antarctic!

We had a council in the hut with Simpson and Nelson. The latter very kindly volunteered to take Debenham's place

THE SECOND WESTERN PARTY THE DAY THEY WERE PICKED UP BY THE SHIP.

Taylor, Debenham, Gran, and Forde.

and help my party across to Butter Point with most of our gear. Then we could rapidly return and pick up Debenham if the rest had sufficiently cured his disabled leg.

On the 7th of November we started off on our first relay. We left about ten o'clock, taking a small sledge from the hut with our sledging gear. We soon picked up our main load on the big sledge, and then began really heavy work. One is always soft and out of condition after the winter, and it takes about a week to get into sledging trim again. It was not very cheering to find we could only get along at the rate of about one mile an hour, for a large part of the gear to be dragged to Granite Harbour, lay thirty miles west at Butter Point! In fact, even with this light load, the surfaces made us relay at times, and the effect on one's body muscles seemed at first almost unbearable. By lunch-time we had only left the hut about four and a half miles behind.

It was blowing strongly from the south-east, and I saw a snowdrift rushing along the ice. When we reached a patch of snow suitable for a camp site, I pitched our tent, and this halt for lunch unfortunately served for supper and breakfast also. It was blizzing hard in ten minutes, and we were only just able to get the tent up in time. Forde was able to help greatly, though his hand was still in a sling.

We were now no longer new chums, and it was pleasant to find that sledging was so much more comfortable than on our first expedition. We now realized that if we could keep out the snow, we should help the human furnace enormously. For every snowflake in or on one's garments, first melted and then turned to ice, and all this had to be thawed each night before one could get warm enough to sleep. So this trip we carried a shilling scrubbing brush, and every one was most assiduous in its use.

It was amusing how little trouble we had in donning our frozen boots now. Some one had hung his on the peak of the tent, while the cooker was going for breakfast, and now they were almost too pliant when we needed to put them on. It was a greater comfort to have a wider floor-cloth. Now the outside men were not pushed into the snow, and our instruments and notes were kept much more securely than on the former journey.

As the blizzard increased it drove snow on to the

windward side of the tent, and the lee sides flapped violently so that the "stocking" door vibrated incessantly. The snow piled higher and higher, and under the ventilator collected a great ball of ice.

We were pretty comfortable very soon in spite of the snow, which covered the sledges a foot deep. A rapid journey to Butter Point was out of the question, and we turned in hoping for better weather in the morning. The temperature was +23° as I ascertained by swinging the sledge thermometer. My last camp in April on Little Razorback had been in −23°, some 45° lower!

Nelson read Poe for awhile in his bag; I read Browning. We were rather jammed together in the drifted tent, and poor Forde next morning said he had been too crushed to sleep! For myself I had never before slept so well at the start of a trip.

At 6 a.m. on the 8th it was still very thick to westward. However, at 7.30 we turned out for breakfast, and after digging up the sledges we got away about 9.40. It is curious how long it took to start off every morning. With no dressing or washing and a simple breakfast of two pots of food, one would have expected a party to be ready in an hour; but two hours was by no means unusual after a blizzard.

The heavy winds had compacted the snow, and also, I believe, covered some of the sticky salty surface. At any rate, we went along better than I had dared to hope, and could do more than a mile an hour.

I soon learnt that it was better to go a long way round rather than cross new snow, and at lunch-time we had done over three miles. Very stiff it made us! The sky cleared, and seemingly a short way ahead lay Butter Point, a face of ice about 50 feet high in which small crevasses showed quite clearly. Yet it was still 20 miles away! To the south-west was a group of dark castles. These were the little volcanic Dailey Isles, which were miraged up into huge squat keeps, very different from their true conical shape.

Far to the north we could see the locale of one of the wildest Antarctic exploits—the mighty crevasses near Mount Bird. Macintosh and a mate managed to cross these during Shackleton's expedition in 1908, after abandoning their tent and losing their food in a crevasse.

How anxiously we watched the little dial of the sledge-meter. Very slowly the miles rolled away, and when we had done four more stages I stopped for a cup of tea and some block chocolate. These short halts did not make one stiff like a longer wait. Finally, we halted at 8.30 after eleven hours on the move. We had sledged eight miles as the result of the day's work, and were already feeling fitter and enjoying our pemmican. How greasy and thick it tastes at first! and yet how soon it seems to vanish almost at sight!

The sun came out and there was a tremendous glare from the snow. Goggles were donned and were not an unmixed blessing. The hot glare disappeared, but sweat rolled down one's forehead and fogged the glasses so that it was impossible to see through them.

On the 8th we continued our "trek" towards Butter Point. There is very little variety on these journeys; you pull till you are tired—not talking much, for that uses too much breath, but thinking of all sorts of topics. As long as one leans forward in the belt and keeps time there is not much else to engage one's attention. Even the leader merely notes some object in his line of march and plugs steadily on until it is time to halt for the five minutes' spell!

At 4 o'clock we were nearly 20 miles from the hut, and therefore, as we halted for tea, still ten miles from Butter Point. It was gloomy and soon started drifting again, always from the south-east and always giving but a short warning of low driving snow before the full blast struck us.

This blizzard lasted thirty-six hours. We lay in our bags and slept most of the time. It is wonderful how one's appetite decreases during these enforced waits. The normal amount of thirty-three ounces of *dried* food per day would be enormous in ordinary life; when lying snug in one's bag, no energy is used in work and little in heat, so that about twenty ounces seems sufficient, and one of the meals can be cut out with ease.

On Saturday morning I turned out at 3 a.m., and a little later it was obviously clearing. The drift was deep over the sledges and nearly over the door. We had been delayed so much that I felt we must now turn back, so we packed the tent and one meal on the small sledge and left a large flag on a bamboo by the larger sledge.

We had only about 100 lbs. to pull and yet the twenty miles (twenty-three statute) was a hard journey. I hoped to be in by noon, but the surface was very bad. We had tea and a biscuit at six and another short meal at noon. We could see the four isles off Cape Evans all the time, and I think our chief occupation while sledging was in watching them take up various angles in front of the Cape as we gradually got nearer the hut. We crossed some landmarks in the shape of the huge shear cracks. One at nine miles, one at four and a half, and a small one two and a half miles from the hut. The last six miles were awful, for the erstwhile mirror-like ice near the Cape was now covered with a sticky film of snow over which we could hardly pull the empty sledge.

However we began to see dead penguins, and then we knew we were within a "dog's walk" of the hut—for these were relics of their occupation. Next we reached the triangular area to leeward (north) of the hut, which viewed from the Ramp was of a yellow tinge from the straw and other debris blown there by the blizzards. And so at 4.30 p.m., just twelve hours after starting we arrived. I immediately rushed Clissold the cook for tinned pears, and found none left. So I started on three rounds of toast. We then had soup, rissoles, and fruit tart. I had three helps of the former and two of the latter and still felt hungry. Debenham's leg had not been going on very well, but was better than on Wednesday. They had had no drift at the hut on Tuesday!

After another council I decided to take advantage of Nelson's kind offer. He would accompany us with the little Russian groom Anton. If all went well they could return; if Debenham were too lame to proceed they could bring him back, and Gran, Forde, and myself would push on to Granite Harbour as a three-man party.

Sunday and Monday passed quietly in the hut though the weather was bad outside. On Tuesday it was very unpromising until 3 p.m., when we could just make out the Western Mountains. At 3.20 we made our final start with Nelson and Anton as a convoy. Debenham hobbled alongside, and as the surface was better than previously and the wind blew to the west we made fair progress. This time we took on our cameras and Day's blubber stove. At six miles we pitched camp and were starting supper when I discovered

that we had left the can of spirits behind. This fluid was necessary to start the primus stove in low temperatures, so Gran and I tramped back to the hut for it. It was a stiff walk, for we were afraid of thick black clouds to the south and the wind rose to sixty miles an hour, luckily without drift. After some supper I turned into my bunk for the last time that year. Gran slept in the bunk above, and as the result of some salmon and a recent perusal of Jules Verne's "Mysterious Island," suffered from nightmare. He explained next morning that he thought Erebus had overwhelmed the Cape with red-hot lava, wherein Simpson had been engulfed, but the geologists had calmly climbed up to the crater! Was this a forecast of his own escape on the summit a year later, when Gran was nearly choked by the fumes?

We found the spirits where we had been packing the sledges, and trudged out to the tents to find the others having breakfast. However, we started at 10 a.m. and did nine miles by 5.30. I camped early to prevent Debenham over-straining his leg.

On the 16th we awoke to find snow falling, though there was not much wind. We had been so much delayed that I determined to try marching through the thick weather lying ahead of us. Although we were fairly close to the magnetic pole, and the compass consequently had very little "horizontal pull," yet I determined to try steering by it, especially as we had a spare man to steer us. We wanted to go almost due west, but the compass direction, owing to the variation, was S. 65° E.! So Debenham marched some fifty yards behind us, and signalled to Nelson, who repeatedly turned to observe him. Meanwhile I tried to steer a course by any object which I could see looming up through the mist ahead. We serpentined considerably at first, but moved steadily westward. Our surprise and gratification may be imagined when we suddenly saw footprints ahead of us, and realized that we had exactly hit on our route of the week before. We had not seen any trace of our track since leaving the hut, and this encounter was as marvellous as finding a needle in the proverbial bottle of hay. On we went into the thick of it till 1 p.m. My eyes soon tired with looking at huge crags, which turned out to be ice splinters twenty yards away. Finally the western hills appeared, and we were all on the *qui vive* to be

the first to spot the depôt flag. Nelson offered his raisins as a reward, and then won them himself! We reached our depôt at 2 p.m.

The sledge was not buried, though a great lee had been built by the blizzards. We had a merry lunch, all six sitting in one tent. Anton's plans caused much amusement. We gathered that he was going back to Russia to marry a rich wife, and so long as she were wealthy we understood that he had no objection even to a wooden leg!

The clouds began to roll away *en masse*, leaving behind a magnificent Italian blue sky, as if the blizzard had purged it of all impurity. The resulting contrast with the dazzling white mountains had something of a Japanese effect, and the afternoon was one of the finest I saw in the Antarctic.

We camped within seven miles of Butter Point. I was delighted to catch Debenham surreptitiously helping with the back sledge, for he found that his leg was certainly no worse for the rough work he was giving it.

On the 17th we moved on with another sledge added. They pulled stiffly, and we met with soft snow every few yards. Moreover, we encountered some "screw pack," which is a very formidable obstacle, and of which we met more than enough in the next week or so. I suppose that here the sea-ice had been broken up and jammed together before finally freezing into a continuous sheet. However, by zig-zagging we made steady progress, and reached Butter Point about 5 p.m.

We pitched the two tents first thing, on the thick snow-drifts near the tide crack. Then we walked up to the depôt, where our boxes stood out boldly, some three hundred yards away.

We dragged up the small sledge and loaded it with cocoa, sugar, pemmican, etc., and then a second time took down 330 lbs. of biscuits. The floor on which the stores had been laid in January was now over two feet down. This gives some indication of the change in the surface of the piedmont ice in nine months. Probably drift accounted for most of the deposit.

The two tents now resembled grocers' shops. In one Nelson and Forde were bagging the cocoa, in the other Gran and I opened tins of pemmican and placed them in weekly

bags also. Meanwhile Debenham prepared a fine hoosh, and Anton conducted a lively class in Russian. In the depôt were some soft captain's biscuits left by Shackleton's party. Forde and Debenham preferred them to our official ration of hard sledging biscuit, and so we made an exchange, for I knew we could always make up deficit by seal-meat.

On the 18th we started off with six men to pull the three sledges; but we found it impossible, and had to relay all the time. We were now crossing the mouth of New Harbour, making for Cape Bernacchi, at its north-east corner.

At lunch we finished off Nelson's contribution of Tru milk, and Debenham took a photo of the combined parties. Then the "Convoy Commando" left us, and we saw them for an hour or so plugging steadily towards Cape Royds. Here Nelson intended to get some penguin eggs before going to Cape Evans.

Now we were left to our own resources, with 1350 lbs. to drag along. I distributed the weight more evenly on the two sledges, putting the heavy biscuit-boxes on one, and the tents and sledging gear on the other.

After lunch we pulled off, Debenham and myself in front, and Forde and Gran near the sledge. The sun was hot, but as usual, when we anticipated trouble, it was not forthcoming, for Debenham was able to help us very materially, and the surface was rippled and harder than we had seen hitherto.

Soon we were hotter than we liked, and our headgear was modified to suit the climate. Forde appeared in a huge panama. Debenham and Gran had felt hats with ear-flaps, and I wore an ordinary colonial felt, which I tied down like a coal-scuttle when the wind was too keen. This day it was warm enough to wear no hat at all, so I walked bareheaded with goggles, "and would have liked to pull off my vest also"!

The screw-pack was low hereabouts, only projecting two or three feet; but the hollows were masked by snow, which made the walking difficult and even dangerous for Debenham. We took the "biscuit" sledge on first for about a mile and flagged it; then trudged back for the "tent" sledge. Debenham met us soon, and pulled with us for the same weary mile. It took about forty minutes to do this, and about twenty to walk back, so that transporting the half-ton over a mile meant

a hundred minutes of very hard labour, which with a light load we could cover in twenty-five minutes.

Well, we had some weeks of it, and by the time five miles comes to be accounted a good day's journey, progress does not seem so slow as it did at first. We used to leave Debenham ahead with the first sledge at our evening stage, and when we three brought up the biscuit sledge we would find that he had nearly got the "hoosh" ready. There was no mention of "too much pemmican" nowadays!

We were now crossing New Harbour. It was interesting to see so clearly the old landmarks of Dry Valley, and amusing to think of our bet with Taff Evans as to the identity of the valley we were now passing. He was convinced that we could not see Dry Valley from Butter Point, and we had had a hot discussion in the previous February on the point.

From this point we saw a most wonderful array of cwm valleys. On the flanks of Mount Lister they were clustered thickly like thumbmarks in a piece of putty. On the slopes of the Kukri Hills we could see steep gullies, as it were, growing into "chimneys," and these into deeper valleys, and so into veritable cwms or cirques. They illustrate an interesting scientific principle. It is naturally impossible to see the stages of valley erosion evolving before one's eyes—as impossible as to see a barrier reef changing into a coral atoll—and yet one cannot doubt that this evolution occurs when we have all the intermediate stages confronting us.

We intended to carry out a very complete survey on this journey. We had two separate instruments, a theodolite and a plane-table. With the former I was able to fix far-distant peaks with considerable accuracy, and also by observations on the sun to determine the latitude and longitude of the main stations of our survey. With the plane-table Debenham carried out a unique detailed survey of the coast-line, not only showing the outlines of the land but also all the physiographic features. By means of the theodolite we were also able to plot the elevations fairly accurately, and when these were added to the plane-table charts I think we brought back from our sledging trip an Antarctic survey unique for its completeness in the field.

The surface for the next few miles was very bad. I wished Wright were with us, not only to lend us his sturdy muscles,

but to study the queer morass we encountered. We were sinking nearly to the knee in snow crystals. These were not wet, but so incoherent that they clogged the sledge-meter, and for the remainder of our journey we had to remember the miles missed from our reckoning before reaching Cape Bernacchi.

The yellow goggles gave rise to a queer illusion. It was just as if we were pulling through heavy sand at the mouth of a river, and owing to some wind and water action, there were the same ripples and channels as are to be seen in an estuary.

Captain Scott had ordered us to leave a week's provisions at Cape Bernacchi, for we should need this if the bay ice went out, and we had to return overland. So we carried up a half-tin of biscuit, and filled it with butter, pemmican, and chocolate. This was reared on end, and protected by a cairn of granite. We surmounted it with one of our precious bamboos carrying a flag. I left a note informing the finder as to our progress, and immediate plans. This was the first of our post offices, of which we established four more during the summer.

Though all this took time, we also made a collection of rocks for Debenham. The loose snow had wrenched his knee badly, so that much as he would have liked to explore our first new land, he was unable to move many yards from the sledge. Marble, granite, tourmaline gneiss, basalts and schists, and a few mineral veins gave us quite a fine collection —though most of them were moraine specimens.

I sketched the coast to northward, observing with great satisfaction that there was no open water in sight. Numerous seals were basking in the next bay, which augured well for our future food supply. Less welcome was the rugged area of screw pack which filled the bay, and which we should have to traverse on our next stage.

Debenham had packed the sledge, and we moved off in the afternoon, winding in and out between jagged lumps of ice, sometimes eight feet high. There was interesting spoor here; an Emperor penguin had evidently passed by, and his sturdy tread had hardened the snow somewhat. Ensuing blizzards swept away the softer snow, and left his imperial footprints standing in relief.

We camped in the screw-pack, and passed a peaceful night.

Next morning the narration of a dream caused some amusement. "I had invited Professor David to dine, and arrived two hours late; as I had no money to pay for the meal I calmly decided to wake, and did so!" We often discussed dreams, especially after my repeating what I could remember of an article in a magazine I had read in the Old Discovery Hut. It pointed out that one's own personality was often revealed in the clearest fashion. I hope the above sample was not of this type.

We reached Marble Cape at noon, and from the top we could see our wandering friend from Ross Island—the three-mile fragment of Glacier Tongue. There was Oates' depôt as clear as ever, and the huge field of ice had almost filled the bay between this cape and one to the north. Its sides projected thirty feet above the sea ice, and we could see that it was largely built of snow, which was folded in a very complex manner, and probably originated largely as snow cornices, just as current-bedding in rocks is formed from steep delta deposits.

To the west, behind the cape, was the sheer front of the Piedmont Glacier. It ended in a face about thirty feet high, and evidently was for the most part moulded over the hills, though a few *nunakoller* projected through it.

We reached a high cape built of gneiss, and camped there for the night, among a colony of seals. We were doubtful as to whether this, or the previous headland, was David's "Marble Cape"; in fact, as some one said, it was a "nice point." At any rate this pun led to the name *Gneiss Point*, by which we knew it.

Next morning it was a blow to our pride to drag the sledge through the numerous seals, and to find that they evidently despised us too much to move out of our way. It was a favourite basking ground, and many square yards of snow were rolled flat and hard by the sleeping seals, while canoe-shaped hollows showed where some unsociable beast had lain at a distance from his fellows.

We started off relaying as usual, but as I was returning I felt this was just the time to test our outfit as an ice yacht! A steady south wind was blowing almost directly behind us, and the next few miles showed a reasonably good surface.

The six heavy bamboo poles, on which the tent is hung,

were so arranged that two could be taken out of the leather bucket uniting them at the top. The remaining two pairs were fixed vertically above the front sledge to form a double mast. We lashed them to the stanchions with lamp-wick. The other two bamboos were used as yards for the floor-cloth. This sail was held up by a rope—actually off Forde's sleeping-bag—which passed over the top of the "bucket" on the mast, and the pull of the wind kept it taut. Two "main sheets" helped to secure things, and passed from the yards to the rear of the sledge. Forde was bo'sun, and made a good job of it. Meanwhile, the delay had frozen the sledges to the sea ice, but after "breaking" them out, we managed to start the yacht and its tender, and to our delight we could just move the half ton along! It was frightfully hard work, especially the start; but we could do a mile in forty-five minutes, whereas formerly relays and halts made this a two-hour job. Luckily, Debenham's leg was now much better, and the miles piled up splendidly. We did $6\frac{1}{2}$ geographic miles by 7 p.m., instead of $4\frac{1}{2}$ by 9 p.m. as heretofore.

In gratitude we called this bay the Bay of Sails; a variation from Shackleton's famous inlet, the Bay of Whales. The coast was fringed by Piedmont Glacier, but a little rock showed at the water's edge. We indulged in extra raisins for lunch, and camped at night near a large cape, which reminded Forde of Spike Island, near Cork.

The ice was evidently affected by the summer breaks, for we had to cross a crack two feet wide, where the water was surging continuously. A young seal here caused us some amusement, its heart-rending "baa-aas" and strenuous efforts to climb a gigantic ridge eight inches high being very comic.

"*November* 23, 10.15 p.m.—The sun is shining brightly for the first time to-day. The tent is flapping gaily, partly owing to the two poles being a bit loose, and partly to the keen southerly wind which is driving over the shore glacier. I am as snug as possible in my bag since I sewed the new left-hand flap thereon. I shall patent this! for a man can lie left or right, fur in or out now. The temperature is +14° F., and the barometer has risen rapidly to 30.14. This change probably means something unpleasant, but Erebus is very clear and the steam going south!"

In spite of hurrying, putting the sail together inside the tent took time, so that it was 10.45 before we started with sail set and a fair wind for the next headland. This looked like a dented door-knob, and we reached it by lunch with the mast bending and the sail bulging in true nautical style.

As we passed it I saw that we had reached Dunlop Island, which had been hidden from us by a line of icebergs. It is separated from Dunlop Cape by a strait about one-third of a mile wide. We hailed this with joy, for it seemed to be pure blue ice; but over this blizzards had blown low parallel ridges of snow which were about 20 feet apart. The snow was sticky with salt, and the alternation of clear ice with sticky snow was almost impassable. For we could not stand on the ice and the sledge would not move over the snow, and when we could pull from the snow, the sledges were on clear ice and the wind drove them along unassisted! I don't know how Debenham managed, but I wrenched my leg, and for days afterwards had cause to remember Dunlop Strait.

Dunlop Island is a mere ridge of shingle about 60 feet high. There was a fierce wind blowing which prevented my taking any photographs, but I managed to get a round of angles with the theodolite before my hands were numbed. There seemed to be four ancient beach-levels marked by well-rounded boulders which point to elevation in this region. Looking to the north we could see nothing but a great barrier wall of ice along the coast. The trend of the latter was almost continuous from Cape Bernacchi, and we could see no foundation for the sharp turn to the north-west charted on the existing maps.

We pushed on for the north along this forbidding wall of ice. It was almost December now, and the sea-ice might break up any day, so that our next few days were anxious ones. We had great difficulty from the sticky surface, and the wind changed direction, nearly blowing the sledge over, so I decided to "down sail" and steer nearer the land. We could only with difficulty pull one sledge, and had to relay till we reached the face of the glacier, where we camped. While Debenham cooked the hoosh—an excellent one, of which I had one and a half pots!—Gran and I managed to climb 200 feet up the glacier front. The ice was much broken and re-cemented with some deep crevasses and queer puckered

ridges. After making a sketch and searching for signs of open water, luckily without result, we turned in and spent a comfortable night.

We awoke to a comparatively hot day! I decided to try one sledge first, and if all went well to tack on the other. But to our chagrin we found that we could not manage *one* sledge. By one o'clock we had managed to struggle along for one mile, in the course of which Debenham had badly twisted his knee.

"I decided to go in for night marching, and we pitched the tent, hung out our wet clothes in the hot sun, and had lunch. Then we turned in and tried to sleep without success. I read through one year of Horsfield's German Grammar, and put a chinstrap on my hat, while Forde darned socks. It was too hot to keep in the sleeping-bags, and so I lay outside without a coat!

"At 7 p.m. it is distinctly cooler, so that ice does not melt now if you touch it."

These abnormal conditions were due to the bright sun, for the air temperature was below freezing. But the solar rays striking the tent melted any snow thereon until there were pools on the flounce, while water inside the aluminium cooker remained unfrozen for hours.

Night marching commenced about 9 p.m. The surface was much harder, and we just managed two sledges for a short distance, but we had to relay most of the way.

To the west is the great Piedmont Glacier, thirty miles wide, and covering a ten-mile belt between the mountains and the sea. The nearer mountains were all rounded and smoothed by glacial erosion, while the higher peaks behind rose into jagged summits, pitted by numerous cwm valleys, which showed that they had never been beneath a thick ice mantle.

To the east appeared a brown island about 100 feet high and a quarter of a mile long. It had a well-defined ice-foot, and I hoped that we were to chart a new island. Gran and Forde were eager to examine this, and while we were surveying the coast they marched a mile or so towards it. But our "island" was merely a stranded berg coloured brown by the large amount of silt included in the ice. In some such way numerous "islands," such as the Nimrod group, have crept

on to the chart, for no one has been able to sight them since their discovery.

We camped just after midnight for lunch, at which I presided. As usual, it consisted of tea, biscuits (hard sledging tack for Gran and me, and soft "Shackleton" biscuits for Debenham and Forde), raisins, butter, and chocolate.

The *Discovery* map was obviously quite incorrect here, and our chief guide was Professor David's account. From the times of his daily marches we expected to reach Granite Harbour earlier than the rough chart indicated, for he speaks of the harbour as being twenty miles out of position! The only place for a bay "five miles wide" seemed to be about ten miles ahead, so that I hoped that a few more days would settle the question.

We got a fine view of Erebus, especially of the old crater whose wall sticks up like a gigantic black fang on the northern slope. Mount Terror was also visible now round the hump of Erebus. The steam banner from the latter was very striking, stretching far to the south, and then, at 8 p.m., shifting to the north after some big puffs. This usually indicated a strong change in the weather—which was the last thing we desired in our present position off the inhospitable face of the Piedmont Glacier!

We camped on rather thin snow and weighted the tent flounce with the biscuit boxes. It was very warm inside the tent, and though the outer air was 14° below freezing, small pools of water lay on the tent flounces in the full heat of the sun. "I made the dinner. The pemmican was not bad, though not so creamy as Deb's, which has a reputation. It is a month to Christmas, and we have been sledging three weeks. I find it much more pleasant than last February, even with our abnormal loads. I plan out things while pulling automatically, and the miles pass along somehow. Camps are much more comfortable, and of course it is warmer now!

"It is very confusing having breakfast at 7.30 p.m., and sleeping or trying to sleep through the day. I find it rather hot, and generally only sleep four hours and think away the other four. However, there is no comparison between the surface by night and by day, for though the sun is bright at midnight he is not nearly so high or warm and does not melt the ice

surface. We camped about half a mile from the huge Piedmont, and set out next day for a remarkable line of icebergs. On our left was the great glacier, the cliff edge dropping to sea-level at a brownish boss which I thought might show some rock. But it was merely stained ice badly crevassed and stepped like a land-slip. I expected to reach this the same night, but luckily our sledge-meter is a better guide as to when we've done enough. Four and a half miles, if we have been relaying, takes eleven hours hard work (less lunch time). Anyhow, the brown boss was still three miles beyond our camp, as we found later. (I expect that the pseudo-island was derived from this breaking ice-cape, for there was a huge group of bergs just ahead of us.)

"I don't take very full geological notes for obvious reasons. We see a piece of rock about every three days!"

There was in fact no leisure for any scientific work. We were too dog-tired to stir far from the tent. Even the ice was unusually uninteresting from a scientific point of view. We watched it with very particular care nevertheless. Hereabouts a rather low screw-pack had been covered by recent snows, and the alternation of hard blocks and trenches filled with snow made a surface calculated to keep us all on the *qui vive*. I took Gran abreast of me in the harness, and so we explored most of the pitfalls, thereby saving Debenham's lame leg from the worst surfaces.

We did some wonderful wriggles, and if the ice ridges were fairly frequent—say every five feet—the sledges revelled in the track. For the runners only touched at these points, and the weight was supported above the soft fields of snow.

It was a wonderful field of bergs among which we now encamped. There were fifteen in all shapes and sizes. Several were low and tabular, while two were higher and cubic in shape. One was a dirty brown, and was possibly a brother of the pseudo-island. Two others were shaped like newts, with a sharp jagged crest. They were, I suppose, overturned bergs.

At 9.30 on the evening of the 26th we left our camp among the bergs, and dodged in and out among them towards the low rocky cape just to the north of us. Huge granite tors crowned it, and great blocks of ice six feet across had been hurled many feet on to the cape by the gales of the

preceding season. I halted to photograph these, and Debenham and Gran climbed on to the granite tors. To my amazement Gran called out that Granite Harbour was in sight. I hastily climbed up and found we were right at it! This small cape was actually the southern portal, and the entrance looked about ten miles across.

As in New Harbour there seemed to be two chief arms, the larger southern portion receiving the Mackay Glacier, and the other being almost completely bounded by smaller inflowing glaciers.

On the cape were numerous skuas, looking very cold, and dancing about on chilly feet. They squawked loudly and flapped their wings at us, but had not laid any eggs as yet, for Forde gave this matter his particular attention! He reported a feasible track across the cape which would save a difficult journey through the screw-pack. I agreed to try the overland journey, and we got across the wide tide crack and up fifteen feet on to the icy col with much less trouble than I had expected. "This col rose to about thirty feet on the north side, and evidently water is driven on to it by gales, for the ice was quite glassy at first. We relayed across, to the astonishment of the skua gulls. We passed a fine little polished platform of granite, and then sharply descended to the sea ice, and by 1 a.m. were within the harbour."

This was very gratifying, and our early arrival was due to several pieces of good luck. Debenham's leg had continued to improve in spite of the gallant way in which he insisted on doing as much work as any of us; we had met with splendid weather since leaving Butter Point; the two days' sail had helped us materially, and finally we found that the harbour was twelve miles nearer than we had reason to expect.

About 4 a.m. on the 27th November we trekked west up the harbour. Far away was a high dolerite cliff with a small glacier just notching its edge. To this we gave the name of "Spillover," and we made for it as a prominent landmark.

We were now naturally very anxious to identify the bluff which Captain Scott had arranged as our rendezvous with Pennell. We were told that it was about five hundred feet high, and Ferrar had described it as resembling a cabbage!

We could see nothing remotely approaching this description, nor indeed anything very like a photograph of it, which appeared in the *Discovery* volume.

We were so interested in this unexplored region that we pulled the front sledge along till the second sledge seemed a mere speck to the eastward. In fact, we failed to notice that the weather was growing very thick to southward, while a threatening tablecloth was covering Erebus. We hurried back. The stage was nearly three times the normal distance. I know it seemed such an interminable distance that I wondered if the sea ice were carrying the sledge away!

We got back to our first sledge just in time and pulled in to a little crag of granite which projected below the frowning cliffs of ice. This we called First View Point, for from it we could see a bold promontory which was possibly our rendezvous. Indeed, the error in the map had made me doubtful if we were in Granite Harbour at all!

View Point was not an ideal camp site. There was no snow, and really no room for the tent. But we managed to get it spread loosely in a little alcove, and though it flapped wildly all night, yet we were very thankful to be on *terra firma* in the blizzard, even if it were only a yard or two wide.

Outside the drift blew in great sheets off the glacier sixty feet above us. The temperature was twenty below freezing, but we were very snug in the tent, and I slept for nine solid hours.

We left View Point next day, as the blizzard was only a brief one, and pushed west. Soon we had to cross a giant shear crack some forty feet wide. Luckily the main channel was frozen in places, and we got across without difficulty, and then reached a small glacier tongue which drained the Piedmont. Very heavy clouds again obscured the south, and I felt it wise to take advantage of this good camping site and sit out the impending blizzard. So we pitched the tent off the end of the tongue near a splendid snowdrift which afforded us perfect blocks for securing the tent. Soon beautiful flakes of snow were falling. Some were delicate crystal bundles like a pine branch, others were like little cog-wheels with six teeth. It continued to snow most of the day, and as night-marching was not advisable

for survey work, I felt that we could now take a little more time and return to day-sledging. We cut out breakfast and kept comfortably to our bags all the morning, having lunch at 1.30. Our last meal had been lunch also! Gran caused some amusement by demanding two cakes of chocolate, as due from the missed meal.

Cooking was a great responsibility, and one that I was never anxious to undertake. Still, even an indifferent cook like myself could not go far wrong with such simple foods as we had at our disposal. Debenham "had a light hand with the pastry," as I have recorded previously, and I used to watch his methods closely. The only "variable factor" was the "thickers" in the hoosh. This ingredient varied a little, from peaflour to wheatmeal or crushed biscuit: but the pemmican was (like the butter at Cambridge) cut to measure! The cook would take out the greasy lumps from the weekly bag and loosely fill an aluminium mug with them. Then he would drop this measure in among the ice and half-melted snow in the cooker and leave it there to boil. Apparently the chief art with the thicker consisted in mixing it to a smooth paste first with a little water—laboriously ladled out of the outer cooker—and then pour it into the "hoosh" just as the mixture boiled up.

It was good stuff! It had a rich taste, especially when solid with ground biscuit after Gran's famous recipe. Months later, when tasting a rich Melton Mowbray pie, a memory of the Antarctic rose before me. There were the four of us; Forde phlegmatically breaking biscuit into his pot; Debenham blowing lustily into his, and finally spoiling it by cooling it in the snow-floor; Gran swallowing it piping hot so that tears came to his eyes, and he fairly wriggled on his sleeping-bag; and lastly, the anxious cook not daring to taste his, but manipulating pots and spoons in the effort to produce steaming cocoa before all the "hoosh" was finished.

I started sledging an ardent cocoa-drinker, but soon realized that there was much to be said for tea at midday. We had a belief that it refreshed one quicker than cocoa, and so we used to have it at breakfast also quite frequently. Upon this journey we did not bring cheese, and I certainly never missed it after the superfluity in the hut. Raisins were allotted to us, but I think "stoned dates" would have been

A PANORAMA OF CAPE ROBERTS, WHERE THE WESTERN PARTY WAS ISOLATED FOR THREE WEEKS, LOOKING NORTH.

AVALANCHE CLIFFS ON THE SOUTH SIDE OF GRANITE HARBOUR. HERE THE PIEDMONT ICE COVERS A CWM ON THE LEFT, BUT IS DISCONTINUOUS OVER THE CLIFFS ON THE RIGHT.

better, for one never seemed to have enough to taste in a spoonful of raisins! The butter was fine! Sometimes I would save some of the precious lumps of sugar; and an original sweetmeat resulted if one bit alternately into the frozen butter and the sugar! The chocolate we usually nibbled at the four-o'clock halt; while any biscuit left over would be dumped into the hold-all pocket on one's jersey and eaten at the same time. Debenham never could eat all his biscuit at the meals, and somehow often had a bit to spare which we couldn't resist.

I used to save some of my evening butter in my pot for the morning. Occasionally hoosh would be poured on it by a hasty cook, and then my biscuit had to be eaten dry; a small matter, for the hoosh was the richer. Once or twice on our trek we came to pools of water, and then Forde would polish up the pots; but thereafter queer mixtures would gradually swamp the true flavours of our foods. The beverage would be "co-tea," or "tea-co," according to circumstances, while suspicions of many of our past menus would persist until another scouring day arrived.

There were some compensations, however, in Polar sledging. One could obtain water by merely digging a cup into the floor, and the absence of flies and of rain were blessings indeed. However, the air was not quite aseptic. Many of the carcases of sheep went bad, and one of our party was very sick from the butter before we finished our journey.

The snow ceased about 4 p.m., and Gran and I walked to the root of the ice tongue to examine it. It was a mile and a half long and was fed by a well-defined overflow from the Wilson Piedmont, which had cut its way through granite cliffs some 200 feet high. There were several "chimneys" offering tracks up the cliffs. One had a rough rock figure at its base, and led Gran to remark, "This is an ome." I realized he meant "good omen," and accordingly we tackled the chimney indicated. Lichen and mosses welcomed us on the flat summit, where some hundred yards of granite-strewn platform marked where the piedmont had retreated from the edge. We investigated the gully between the tongue and the cliffs, here almost vertical. As usual there was no sign of grooves or striation, though the ice was much disturbed at the base of the cliff, and we had to cross many small crevasses.

Early on the 29th I waked the others, hoping to make an early start. Unfortunately something went wrong with the primus; I am afraid some spirit was mixed with the paraffin. At any rate we had an anxious hour testing the apparatus, which formed our only source of heat while sledging, but found nothing out of order except the fuel.

We had been looking forward to sledging over the vast sheet of clear ice within Granite Harbour. But the late snowfall had ruined our chances, and we had practically no easy sledging during the whole of the journey. Personally I was so pleased that we had safely reached the Harbour, that a day or two more or less now did not worry me.

At the end of the second stage Forde discovered a cave in the granite cliffs. It was about fifty feet high and twenty feet wide. I think it was due to the sea tearing out the loosened blocks along a large fracture in the granite, though such an occurrence is necessarily rare on icebound coasts.

I was very anxious to find a suitable spot for a head-quarters camp, and so far not a single spot was large enough to pitch the tent upon. In the bay just east of the huge bluff there seemed to be some rock slopes. Most picturesque at the head of the bay was a great granite cliff festooned with narrow glaciers hanging over like ribbons. We heard several avalanches here, and so called the place Avalanche Bay. In the corner was a steep slope of glacial debris—partly mud and partly gravel and boulders. We climbed up this for two hundred and fifty feet, and so could look down on a small glacier which occupied a bowl-shaped hollow in the coast-line. This would appear to be a cwm valley into which the Piedmont Glacier has flowed.

"After supper it cooled somewhat, and we started out for some relay work. We could see the Bluff quite close, and after half a mile I judged we were halfway and went back for the second sledge. Then on again, and we never seemed to get any nearer. It was nearly two miles off and we were all tired on arrival. However, we plugged back for the second sledge, and it was a weary grind! As Debenham remarked: 'We were too tired to think!' We got in about 11.30 and pitched camp on poor snow, fetching blocks of ice from the wide tide-crack to weight the flaps.

"We were much amused by the laments of a young seal

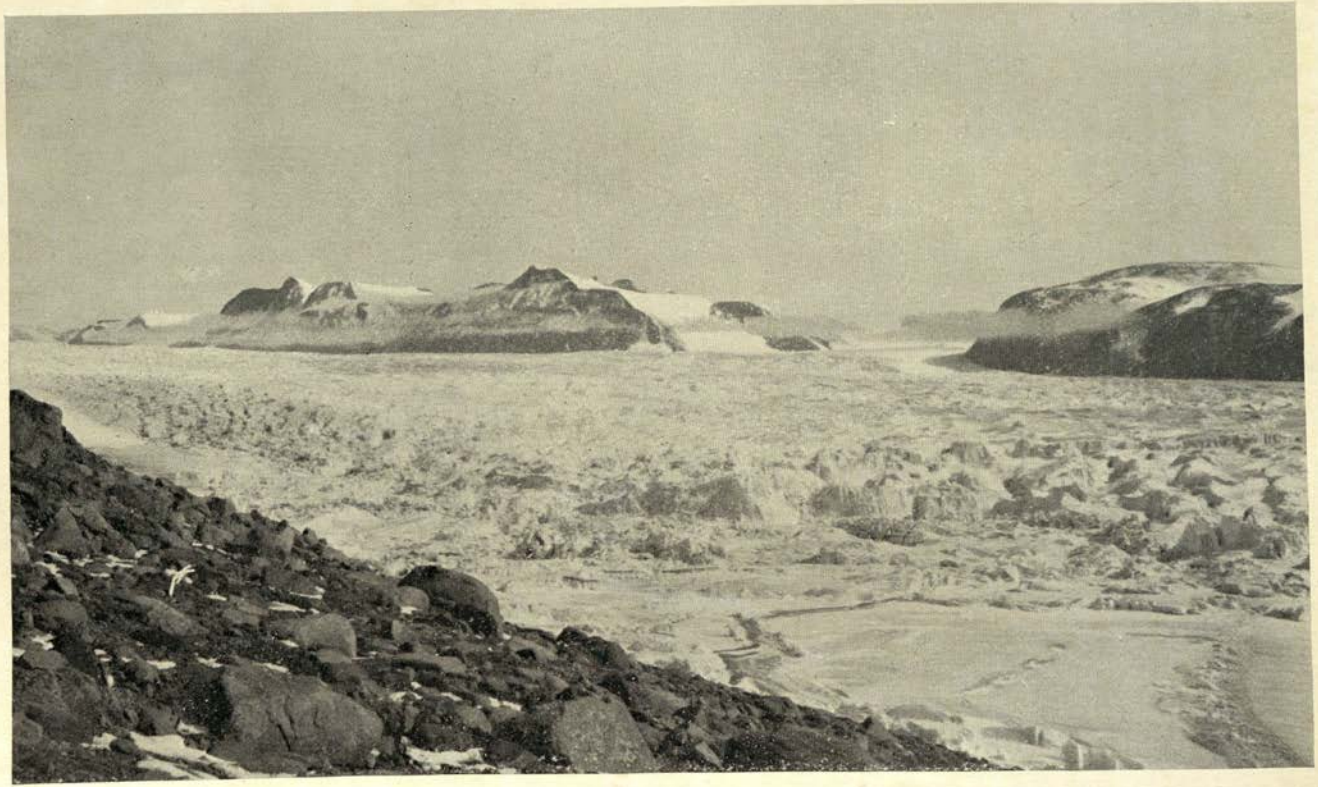


Photo by Gran.

THE FIELD OF CREVASSES (SKAUK) AT THE ROOT OF MACKAY TONGUE, JAN. 6, 1912.

Behind are the faceted slopes of Mount Allan Thomson. Photo from the Flat Iron looking N.W.

(still in its woolly coat) for its mother. 'Baa-aa!' he said, quite plainly, like a cross between a lamb and a vigorous young bull. This resounded from the five-hundred-foot granite cliff above, and occasionally the mother re-echoed it from the tide crack where she wisely kept! I was glad to see about eight seals here. I expect we shall kill most of them! Trigger caught the young one by the tail, and it bellowed and tried to get away. It took to water readily. There was a well-defined margin of level fixed ice, ten yards wide, following the coast all along. We turned in at midnight tired out and not much worried by the baa-ing of the seals."

Before turning in we saw a most remarkable sight to the east. Sailing over the Ross Sea towards the south was a fleet of cloud galleons. The hulls appeared as bright white glares separated from each other by dark nimbus. The lower sails were sheets of stratus, and beautiful cumulus floated over each. At the front of each the advancing vapours were curved to form the galleon's bows.

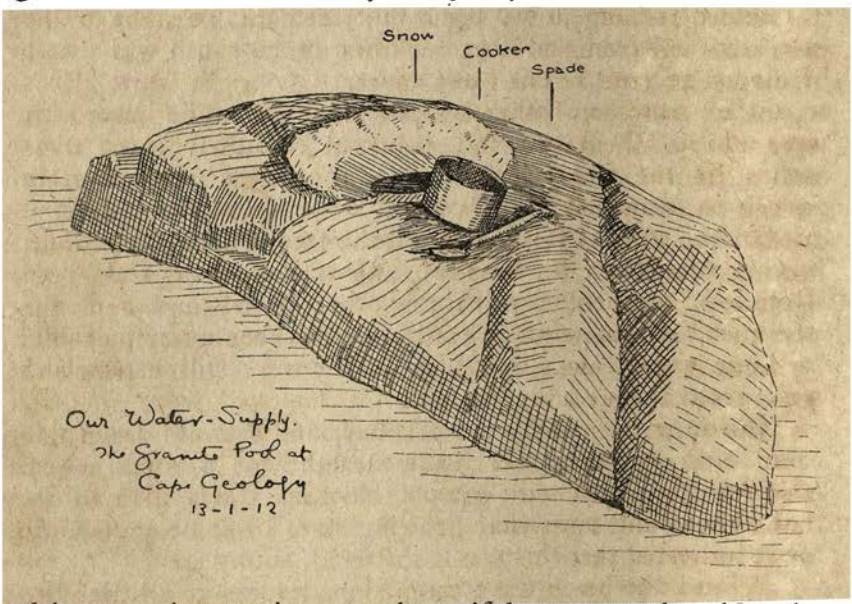
On the 30th we relayed round the face of Discovery Bluff, leaving one sledge on the firm ice-foot beyond the seals' pool while we marched on with the other to try and find our summer headquarters. The Bay ice was torn every half-mile by huge shear cracks, but luckily they were still narrow and we crossed them readily enough.

We now opened up a small bay, and I could see a fine camp site just ahead. I made straight for a rough beach which was covered with granite blocks. I was glad to see that lichens and moss were growing here in some abundance, for it indicated that this was a sheltered, sunny spot.

Behind the beach was a steep slope leading to a little plain about four hundred feet up. I climbed up to this while the others explored the beach and the small cape to westward. Soon I reached the further edge of the plain, and from here I had a magnificent view up the great Mackay Glacier. There was a well-defined glacier entering the bay in the south-west corner, which had a fairly gentle slope. Up this I hoped to find a route to the interior, for the other outlets of the glaciers were crevassed to a greater extent than in any of the other regions. In fact, the ice river resembled a great ploughed field where every furrow was a huge crevasse. Gran said such an area would be called Skauk in Norway. He said

they used Icelandic terms for their new words, much as we do Greek. I think this term might be introduced into our nomenclature, at any rate we used it thereafter.

Meanwhile Debenham had found an excellent spot for our permanent camp. We were very satisfied with the outlook. One reads of the advantage of a "gravel subsoil." Here between some large boulders was a patch of gravel. To be sure it was full of irregular blocks of granite and half covered with snow; but by hand-picking it and raking it over and over we rid ourselves of the "feathers in the bed," and also got our tent-site ultimately fairly dry. The small elevated



plain was going to give us a bountiful water supply when the weather got warmer. In fact, Debenham entered into a disquisition on "hydraulic grades" and the "origin of springs," to show that we should have water laid on past our tent! The snow never melted sufficiently for running water, but Forde evolved a fine reservoir in a few days He cleaned out a hollow in a huge granite tor, and the sun's heat acting on a snow dam at one side usually gave us a sufficient supply. Great blocks of bay-ice driven up in a previous summer formed our cool storage. Just off the Bluff was fuel and food in the shape of seals. Buttresses of

granite crossed the beach, and between two of these was an area where our kitchen was almost half built. Surrounded on three sides by solid granite walls three feet high was an enclosure which we managed to roof in well enough to hold the blubber stove. Forde and Gran were especially keen on this edifice, which they called Granite House from Verne's "Mysterious Island."

It was a day or two before the house was finished. Forde was master mason and Gran chief labourer. He used to delight in bringing to the site great cubes of granite which we others could hardly move. There was a most uncomfortable block of granite projecting into the hut, but by the repeated dropping of huge blocks on to it, Gran finally managed to remove this excrescence.

After lunch on the 30th Gran and I went off to obtain the wherewithal for our first seal-hoosh. Luckily there was a seal a quarter of a mile from the camp, and we soon slew him in the usual manner. Gran would attract the doomed animal's attention, while I stole alongside from behind and stunned him with a blow on the nose. This was almost the chief use I made of the geological hammer, for Debenham was making the rock collections while I studied glacial topography chiefly.

Forde gave us a lesson in butchering. Most people do not realize that a seal is not far removed from an otter. Anyhow, his anatomy is near enough to that of a sheep for one to know where the choicest meat lies. In fact, a seal's skeleton is just like a sheep's, in which the two hind legs have been folded together close to the tail and converted into swimming flappers.

We cut off two wide strips of blubber first from the belly; then rolled the seal over—an operation of great difficulty—and obtained two more from the back. Beneath these strips of blubber were the best portions of the flesh, except the liver, which needed especial anatomizing. Around the neck I cut off odd bits of blubber, and one of these served to cook a meal on the stove, so that there was plenty of fuel on a seal to cook the meat it provided.

We staggered back laden with spoil, leaving the carcase to a multitude of skuas. How they quarrelled and fought over the pieces! Every skua seemed to prefer to grab a piece already selected by another. I suppose they were not used

to tearing fragments off such a superfluity of carcase! We welcomed these visitors, for we had in mind future tasty dishes based on skua eggs.

It snowed during the night, about one inch falling, chiefly as needles and fluff-balls. All this spoiled future sledging, but we watched it philosophically now that we had got our main supply to its destination.

I turned in later than the others, and, on having a last look round, I noticed some dark specks floating on a little pool. With no organic matter in the air, this seemed unusual, and on closer examination I found that these were the long-desired insects! They were little bluish fellows shaped like a cigar, with six legs and no wings. I was very pleased, and rushed to inform my sleeping mates. I am sorry to record that they did not seem to think the discovery worth the loss of their first sleep! Each insect was about one millimetre long, so that twenty-five only measure an inch, and they clustered together like aphides.

Gomphocephalus.
Antarctic "Springtail."
1.12.11

Next morning I received congratulations, as it was my birthday. The sledge flags were hoisted on a line between two depôt poles. We hung up the red-and-black depôt bunting also in honour of the occasion. Debenham said he had no present for me, but he could not allow me to cook my birthday dinner. I noticed that the others seemed overjoyed that I should be relieved of my cooking duties for one meal!

"However, I did breakfast, and made a fine hoosh. The great secret is to mix the wheatmeal, pepper, salt, etc., well, and pour it in *just before* the pemmican boils, giving it only five minutes. It is much more slippery and soothing than if you cook the 'thickers' longer. I shall be quite an accomplished cook later on!"

About 11 a.m. Gran, Forde, and I brought the other sledge in from the Bluff. After lunch we unloaded the stores, mustered them, and placed them under a big rock until the hut should be ready to receive them.

"We seem to be especially rich in raisins. I fear I forgot

to take out a bag at Cape Evans. Gran is going to sow sea-kale here, so that our vegetables and fruits should be plentiful!

"About 5.30 a long streamer of smoke announced that the famous stove was going, and Debenham made a splendid liver-fry, followed by cocoa in very quick time. Gran produced a bottle of Savoy sauce, which he had carried as part of his personal gear, and presented it to me. No present could possibly have been more acceptable, as any one who has lived on one dish for a month will realize. I could have eaten two whacks of the fry easily! We decided to use the bottle at one meal instead of spinning it out, but (as Wendell Holmes remarked about the honeypot) you can't pour out the last dregs from a sauce-bottle. Some one suggested we should draw lots for these precious dregs. (Privately I thought they belonged to me, but I nobly agreed!) So, in the way they have in the navy, I thought of a word of five letters, and I said that the last alphabetical letter should win the prize (as a matter of fact I had thought of 'Savoy'). Gran gave me the third letter (*v*), and he took the first. Debenham took the fourth, and then I felt safe. But Forde took the last (*y*), and so won the sauce. A very sorrowful moment! This ingenuous game always entranced me; it trusted so implicitly in the leader's lack of American 'smartness,' for the word was not divulged until the numbers were out!

The method bewildered me when I first heard it, but I hope the above account is lucid.

The next day Gran became cook, and gave us a fine hoosh, after which I started trying to get the astronomical position of our headquarters. Gran explained the way the Norwegian fishermen obtain latitude and longitude by very simple yet sufficiently accurate methods. They observe the sun at 11.30, again near noon, and at 12.30. By this means they get the local time of noon by calculating halfway between the other two observations, which should be nearly the same reading. The noon reading is a check.

Unfortunately in 77° S. the sun pursued a placid path which was nearly horizontal, and it was very difficult to find the "keystone" of such a flat "arch" as he described!

We had unloaded one sledge and converted it into the roof-tree of our granite hut. It was necessary to collect

sealskins to cover our house, and as the walls were now high enough, Gran and I went off on a fur-hunting trip. About half a mile away was a big seal, and I determined to secure him.

"It was extraordinary how long the muscular action lasted, for this animal was stabbed three times in the heart and pithed three times in the brain. We had great difficulty in turning him over; there is nothing so slimy, heavy, and sloppy as a huge sheet of blubber and skin. We managed to roll the heavy hide on to the sledge, but it would not stay there. Just like a slow-moving glacier it slipped off everywhere. 'Trigger' took off his belt and lashed it on, and we managed to start by sticking the ice-axes in to keep some from dragging in the snow. We had to cross an ugly shear crack about four feet wide, regularly torn in the floe by the pressure of the glacier, but it was no trouble by using the interlocking promontories. We cooked tea on the blubber-stove, whose white smoke lends homeliness to our headquarters. . . . We named the latter Cape Geology, in memory of the chief object of our journey, though we had been able to do very little scientific work so far.

"After lunch Debenham and I proceeded to flense the blubber off, laying the hide on a rounded boss of ice. It was slow work, for the sun warmed the blubber so that it was as easy to cut as flannel two inches thick. We dug out a cache between two blocks of ice and put the meat and blubber therein, covering them with smaller blocks of ice, and this storehouse served well after we had taken the precaution to mark it with a bamboo, so that it was not lost in the snow.

"I made a granite seat in the hut, and will have a fur carpet, for it is cold for the toes on the snowy floor. The stove smokes badly, but gives off enormous flames and heat, only burning 10″ × 3″ × 10″ of blubber per meal. . . ." Soon, however, the soot and oil filled the bottom of the stove, and then it ran out over the rocks and spread all over the snowy floor. We had to stand in this fearful mixture, which is dirtier than the grease in a foul motor engine, and much more ubiquitous. The smoke made one gasp as eddies drove it into the face, and we never managed a door for the hut to keep out the icy winds blowing down from Mount England.

The sledge ran along the centre of the roof, and the chimney projected through it. Biscuit-boxes helped to form

the roof, but sealskins enough to cover it were gradually collected. Forde said it was as good as many an Irish shebeen, which made me pity the Irish more than anything I had yet heard of them! However, it saved our fuel, and kept our field notes and sketches cleaner than if we were cooking in the tent, so that we feel that this sample of Antarctic architecture fulfilled a worthy purpose.

"I cut up the seal meat and insisted on adding meat to the liver, for we should need to kill a seal every other day at the rate the cook wants liver! I'm bound to say that I am the biggest eater. Gran had a reputation that way, but he has not eaten as much, and Debenham and Forde are very poor eaters." It was very cold in the granite hut. I sat in the doorway to try and keep out the draught, and was very glad to trot out and warm my toes after cocoa. "The skuas don't show any particular inclination to lay yet. Perhaps they see it won't be worth their while. Nor do they seem at all anxious to clean the blubber from the sealskin we left for them."

Our tent was in the shadow of the Bluff all night, and so it was quite cold in spite of the midnight sun. Gran and I set out next day to put up the rendezvous flag, and to kill a seal, while Forde and Debenham finished the hut.

We climbed up one of the chimneys or steep gullies which scored the front of the Bluff for several hundred feet, and then got out on to a knob, where we raised a red flag on a stout bamboo pole. I found a fine deep crack, and Gran wedged it in very solidly with blocks of granite. From this view point I made a great discovery, that there is an ice tongue about one mile wide and five miles long, projecting from the *skauk* of the Mackay Glacier. Bay ice fringes the cliffs beyond it, and as the map shows, the tongue extends almost down the middle of Granite Harbour.

We had many arguments about this tongue. The *Discovery* must have been close to it in 1902. Debenham was inclined to think that it had grown since that date; but later we saw a photo from the *Discovery* which showed that it was in existence then.

I wrote a note to Pennell, and lashed it to the mast, telling him we were going inland till January the 8th. We then hurried down the screes, and went out on the bay ice to slay

our seal. "He died rapidly, thank goodness, and we plugged through our job till about 2·15, having an awful time tying the hide and blubber on the sledge, while the liver lobes ran all over it. Gran swears they worked their way uphill, and came out of the folds of skin! I threw some bits into the shear-crack, while washing the liver, and the hole was soon full of amphipods, which are cousins of the shrimps. Gran says he is going to fish hereabouts if he can get a hook."

On the 4th December we began to collect gear for our next trip. Forde spent a lot of time at the blubber stove, where he was the most expert cook. He cut up large lumps of seal, and fried enough for eight meals. This was mixed with pepper and salt, and about half cooked. He then filled a large tin with this rough substitute for pemmican, and lashed it on to the sledge. I used to enjoy a snack of this half-cooked seal between meals, for there was now no doubt that our appetites were of the true Antarctic variety.

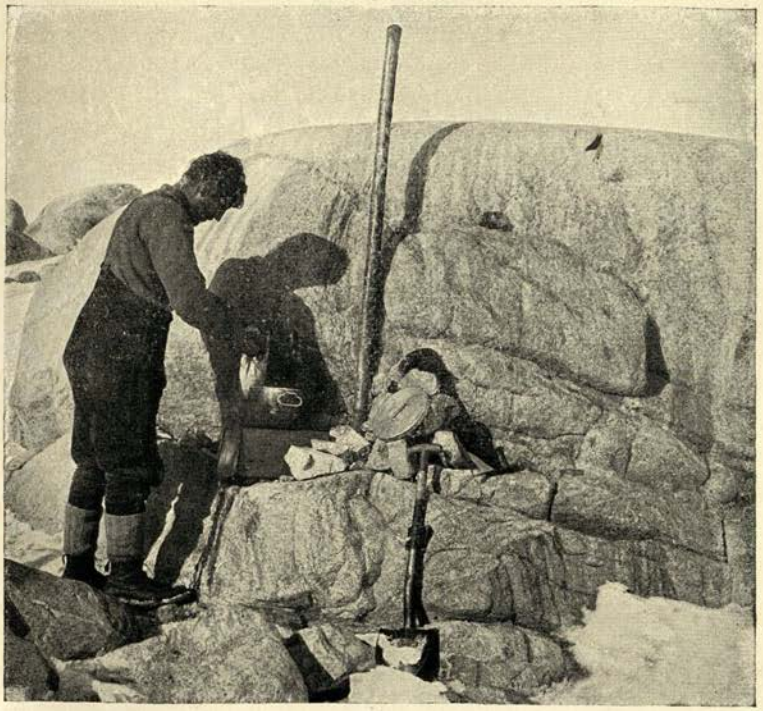
We had cleaned several skins now, and we fixed them over the roof-tree of our hut. I sewed up the flipper holes, and each skin was about eight feet by six. We lashed them to the sledge, in the middle, and then hung huge stones from the outer margins, which drew them taut, and held the skins close to the walls. They soon became very sooty, but were always translucent, for the hairs are large and coarse, and not at all closely set. We could just stand up under our sledge roof-tree. Forde spread gravel over the blubber-ice composition on the floor, and I gathered some moss and tried to stuff up the crevices therewith. When the cold wind blew down the hills it invaded our hut, and made us glad as soon as the sooty meal was over, and we could take refuge in our snug little tent below.

That evening Gran and I climbed up to the top of the bluff, above the flag. The sides were covered with granite debris; some colossal blocks were twenty feet across. In the clay beneath them were mosses and lichens, one of the latter being of a fine frondose shape, with root-like attachments. I collected this specimen, and boxed it on my return; but the skuas had scattered our specimens when the ship's party finally arrived in 1913.

We got up in about one hour, and I began to have my doubts about the five-hundred-feet height mentioned in the 1902

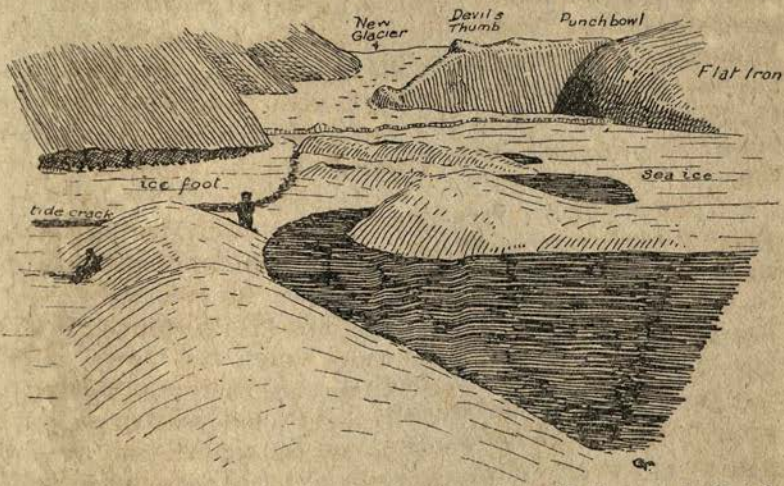
GRANITE HUT, CAPE GEOLOGY.

Forde and Gran are cooking at the blubber stove, whose chimney projects behind the "sledge" roof-tree.



FORDE COOKING SEAL-FRY ON THE BLUBBER STOVE AT CAPE ROBERTS.

record! Luckily, I had an aneroid, and this showed it to be over fifteen hundred feet high. I got a magnificent view of Granite Harbour and the Mackay Glacier. The large ice tongue ended in three splay "fingers," and was badly crevassed, except right at the end. Far to the east I could see Mount Erebus and Beaufort Isle. Below was a regular succession of shear-cracks, due to the irresistible pressure of the Mackay Tongue pushing out the bay ice. Great pressure ridges, six, ten, and fifteen feet high marked where the bay ice was being jammed on to the Bluff. These were very prominent near



Pressure-ridges in the sea ice, looking west from Cape Geology to the Punch Bowl cwm, January 13, 1912.

Cape Geology also, and pools of water collected in the hollows between the ridges.

On the afternoon of the 5th we started to the north, to march around the end of the Mackay Tongue, which lay about five miles off. We were now crossing ice covered with nearly a foot of snow; but with only one sledge and ten days' food, we got along in fine style. We could easily see our signal flag flying on the Bluff, and the red showed quite clearly when the wind blew it out. We reached one of the "fingers" at the end of the ice tongue about 6.30, and here I decided to camp, so as not to lose sight of our survey stations.

"There seems to be no large tide crack here, which means

that the tongue is floating. It is broken into deep lateral bays, and consists of regular rolls and hollows. I don't believe that storms affect this harbour much, or it would have gone out long ago. We pitched the tent on soft snow, just off the end. I got ice from the glacier for the cooker, which Forde declared was salty from old sea spray. Anyhow, the hoosh was very good."

Far to the west we could see a huge black mountain projecting through the Mackay Glacier. It was formed of black dolerite capping granite, and reminded me of a three-cornered Chinese junk. Debenham objected to this name as being unworthy of such a fine nunatak, and proposed Gondola Mountain. We knew it by this name during our expedition, but on my return to Sydney I discovered that Professor David had seen it from the coast, and had called it Mount Suess. So Mount Suess displaces Debenham's euphonious title.

"The sky looked very ugly—the sun dimly glaring through gloomy clouds—a low, thick, dark bank on the eastern horizon, and the barometer falling half an inch in the twelve hours. So far nothing has happened, but now (10.30 p.m.) snow has just begun, and may keep on some time; for I see, from the log, that we had similar conditions at Harbour Tongue on the 28th. The temperature is + 23°, and we are very comfortable; for though we are on sea-ice, yet we can reach the glacier in twenty yards, and there is twenty miles of ice between us and the open water."

I am going to copy my notes, for the next few days, *verbatim*, for they give a fairly complete account of a typical summer blizzard in Antarctica. If the language seems a trifle strong, the circumstances should be considered.

"*Wednesday, December* 6, 1911.—10 a.m. We are held up in our first violent blizzard, and it is just a month since we started. We have had snow blizzards, but this has wind force about 7 as well, and the drift is thick and wetting.

"We have a pretty snug camp on snow, one foot thick, which you can accommodate to your hip-bone, but which it is difficult to stand the Primus upon (especially as the cooker *base*, on which it usually rests, is full of fat, and is now our frying pan at the *hut*). It started snowing about midnight, and clothed the tent by 3 a.m. I woke to hear the tent

flapping, and shaking down young avalanches, and it has been going strong ever since.

"There is always a strong bulge *in* on the windward (S.E.) side, and slighter bulges at the two lateral tent segments. Then the door, if properly placed, tends to blow *out*, and the laterals next to it do most of the flapping, and make a deuce of a row.

"2 p.m. Still blizzing strongly; there have been one or two lulls of a few minutes; but they don't seem to mean much. It is snowing furiously, too; pattering on the tent like rain on wooden shingles. If you budge from the tent (Debenham had to get a note-book) you get very cold, because the drift melts and wets you at this temperature (+23° F.). We had a meal about 11 a.m., Gran cooking a good bovril-pemmican, with a large supply of broken biscuit therein. This strong south-east wind blows practically direct from Cape Roberts on to the tongue on our lee, and so I do not much fear it will shift out any ice. Anyhow, we can't move, and I am learning to take these blizzes philosophically. Besides, the bags are dry and warm, and when I tire of writing the diary I snooze a bit, and then read Harker's 'Petrology' (Deb's), and then snooze, and then read 'Poe's Tales' (too fantastic and oriental to please me are most of them), or 'Martin Chuzzlewit,' or do some German grammar. Forde is actually reading something. He has tackled 'The Mysterious Island' which Gran has nearly finished at last. Deb started to work out a latitude, but is now wrapped in 'Morfus.' Last night's hoosh was an enormous success, 2½ pots of Forde's concentrated seal hoosh, mixed with water and meal, made a top-hole hoosh—very tasty, and all indigenous.

"6 p.m. The tent is beastly sloppy. We have just finished our *lunch* at 6 p.m., and if we can't get away, that is our last meal to-day! To-day is a queer camp, the first down here where the tent has dripped on us, when no Primus is going. We have put the cooker under the tied-up door, and it is filling, I see! Forde is dressing his finger with a pen-knife, and Deb keeping warm very sensibly in his bag.

"*December* 7, 1911.—Slept pretty well. Dreams, as usual, furnished some conversation 'twixt Gran and me, and occasionally Deb. I had a very vivid one (or two) after two pots of seal fry the other night.

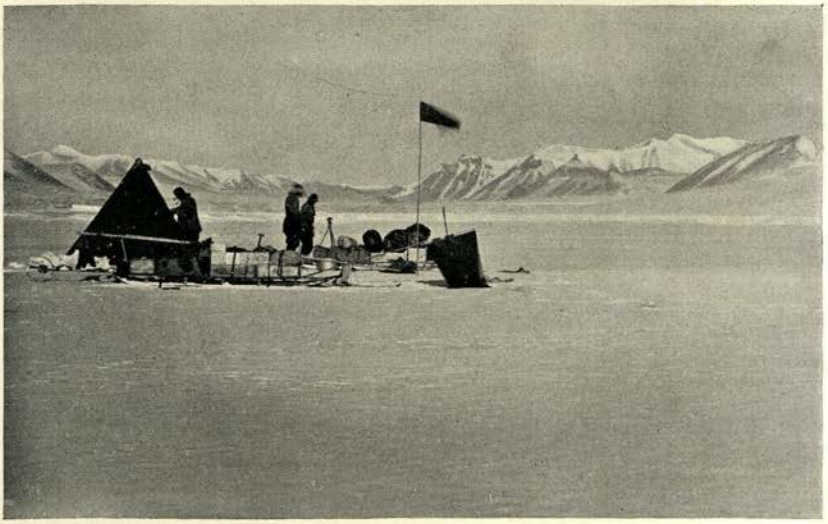
"I was walking to Sheffield and got lost, and couldn't get any one to tell me the way. I asked a man and couldn't get any great satisfaction out of him. He saw some of my Antarctic gear in my bag, and said I looked as if I was going to the Pole, but would not believe me when I said I'd been there! I then told him my name (to impress him, no doubt!), and he was not a bit concerned, but said his name was *Taylor* also! Then I switched off home, where everybody was much concerned about the end of the world, or something equally cheerful. There was an awful red sky to the south which caused great perturbation, until finally some one called out, 'It's the return of the mail-clad "goater"-cars from the Pole!' These were a sort of red motors assisted by goats, and were quite the latest thing in transport evidently, and I was much pitied because I didn't know all about them. But a bad pun in a dream seems to denote too much fry!

"It is now noon, and we are still snowed up off the end of Mackay Tongue (43 *hours* now and we have not got *away*). It dripped most of the night, for the temperature was +27° outside and warmer inside. There was a puddle by the door, but Gran and my bags have absorbed most of that, and Deb's is wetter. So far the inside of mine is still O.K., and I have fur inside always now. It is much warmer, and as soft and comfortable as anything I've slept in as far as I remember. We have been trekking over a month, and though we've had almost unique hard relaying for two weeks—330 per man—yet I enjoyed it much more than the Ferrar trip under better conditions.

"We got up at 8, and Gran made a biscuit-bovril-pemhoosh, which was very good. We had only two meals yesterday, so went a full whack this morning. I put on my boots and wind-coat and puttees, and dug out the thermometer. The sledge is buried two feet in snow. Deb's big camera tripod shows above the snow, and a bamboo pole—also the top of the shovel,—but the rest is clean buried. The first fall of snow was consolidated by the blizzard; the last fall, *since* 2 *p.m.* yesterday, is fluffy light stuff and quite different in texture. I dug down to the biscuits and got Deb's note-book, and then came in and scraped off the snow and had breakfast. I have finished 'Martin Chuzzlewit' this morning and puzzled over German declensions, and still we can't see more

HEAVY SLEDGING OFF MACKAY TONGUE, JUST WHERE WE TRIED TO PACK TO LAND, DEC. 8, 1911.

Note the great furrows due to the sledge dragging bodily on the snow.



THE "HALF-TON" AFTER NELSON LEFT US, OFF THE MOUTH OF DRY VALLEY, NOV. 18, 1911.

Notice the ice-free character of the valley and its faceted walls. Beneath the flag appears distant "Matterhorn." The sledge-meter shows to the left of the tent.

[See p. 339.

than a hundred yards, and it is snowing still. We got a watery glimpse of the sun about 9; but he's gone, though, as the north side of the tent is dripping most, I suppose he's still about. There's a constant rainy patter on the tent, but the snow is so slight it would not matter if we could see where to steer! However, it's not hard work lying still here, and Scott did it seven days; we've only had two.

"The barometer (29.45) is rising steadily, which denotes, I think, no more strong wind at present. Our short, sharp blizz was correlated with a very low barometer of 29.18, whereas 29.80 is about the mean hereabouts.

"There is no tide-crack off the Tongue, which is five miles from its parent glacier, and therefore must be floating. Also, as it projects a hundred feet above sea-level, it must be 500 *feet thick*, which is comforting.

"We had lunch about two and saw blue sky to the east, Erebus showing partly; gradually the whole snow cloud blew over *en masse* to the west, leaving blue sky and a bright sun. We dug out the sledge, nothing of which showed, and got off after Deb had taken a photo.

"We could hardly get a move out of the sledge and finally harnessed so as to beat out a bit of a track. The going was awful. Never had such hard work, and with only one fairly light sledge! It pulled me flat on my face in the soft mushy snow, and wet me half up to the waist tramping through it. We managed to get around to the end of the Tongue and one mile to the north, and then it was after 7 p.m., and I could not stick it, nor could the others. We pitched camp in the middle of North Bay. But our floorcloth and tent are dry, which is a great comfort, and we had a fine seal-hoosh. The trouble is that all our survey work will be blocked; for two miles' progress in three hours is deadly, and this snow is universal. However, I'd rather have it now than earlier, when we had two heavy sledges, for we couldn't possibly have moved either! Perhaps it will cement by to-morrow a bit. The temperature is down to $+13\frac{1}{2}°$ (after 27° or so) and the barometer is still rising steadily. I feel a bit wet and will turn in early.

"The Tongue is very imposing from this (north) side, being cut up by bays so deep that they seem to separate it into islands. We hope to make the end of the Kar Plateau—

a long 800-foot flat-topped shelf—which seemed to show a bit of beach. We had to camp at what seems one and a half to two miles away in soft snow, which we kicked away and shovelled off so as to get a fair spread for the floorcloth.

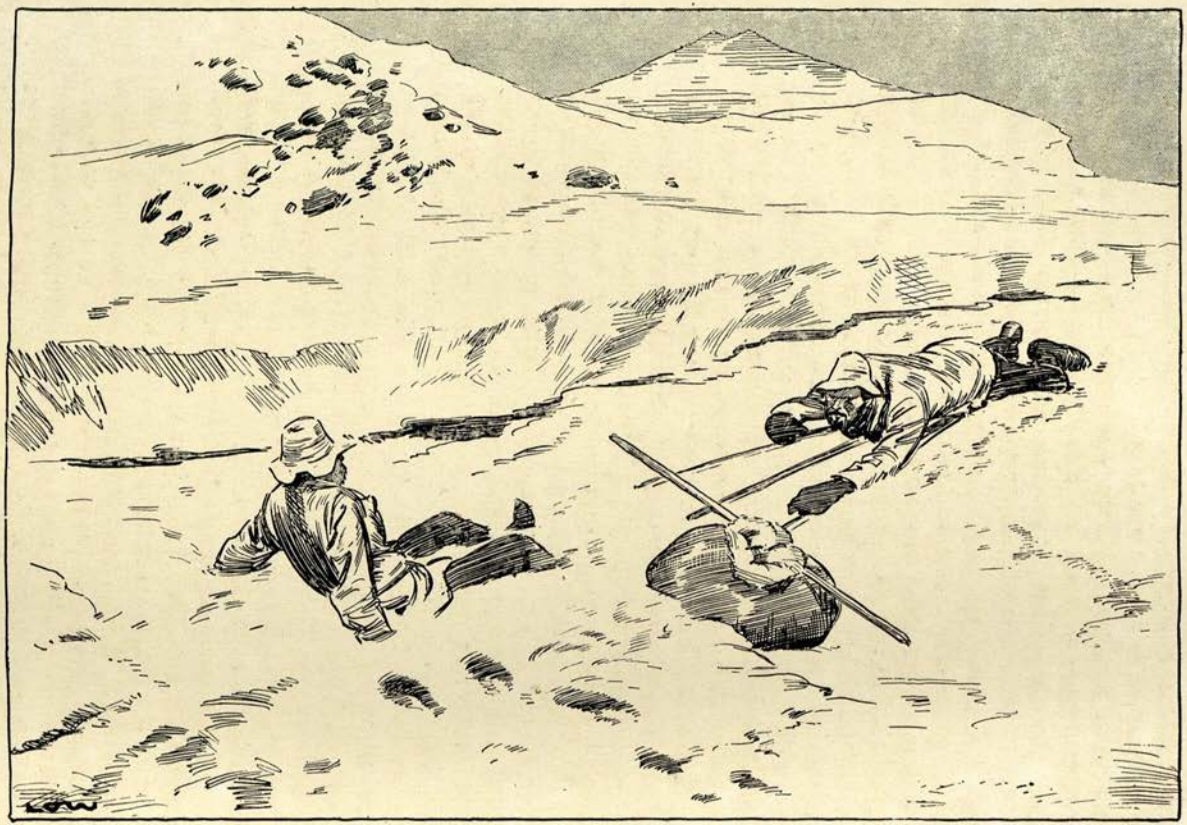
"*Friday, December* 8, 1911.—I doffed some of my clothes and hung them up inside the tent, if so be they might dry a little. Result, like a board, for the temperature was only +13. However, I used my eiderdown, and was jolly snug and warm and slept quite well.

"My bag is wet outside and it wet the floorcloth. Trigger's you can squeeze water out of. We must get a drying spot on the coast. It is a fair morning with a gusty, cold, plateau wind (W.). The sun is shining low down in the east through cirrus; but it does not look snowy or blizzy.

"(Written Saturday 8 a.m.) We were about two miles from the coast, the nearest being the end of the *Kar Plateau*. We loaded up the sledge and gaily proceeded in that direction, anticipating arrival about noon. But we found we could not pull the sledge, though I doubt if there is 400 lbs. on it. It just stuck, with the prow covered with soft snow. Forde gave words to 'pull all together' (for he could see better than I, being at the back), but it was no good. So we stuck up the flag pole and packed all we could carry on our backs. Gran went first with his very heavy bag (half water) and the tent poles. He plugged away in great style, but made rather a devious track as different parts of the coast appealed to him! Deb followed with a rucksack on his back and his bag also (and the plane-table halfway). Forde took the tent and cloth, but didn't wrap them up carefully, so that they rather impeded his movements. I came last with a proper swag—rucksack in front and bag behind, hung over my shoulders on my belt. There we were trekking for the land to dry our things a bit and do some geology. Gran got rather far ahead, and by the time we arrived near the rocks he was manœuvring with the tent poles near the tide-crack.

"This was most unsatisfactory; a high ice-foot about two feet or more, separated by one or two feet space of open water, was bad enough, but nearly forty feet of the floe was soft and mushy, and through the thick snow you could not tell which was hard ice and which was open water.

"There were seals all over this mushy stuff, and one came



A TIGHT CORNER! CROSSING THE FORTY-FOOT TIDE CRACK OFF POINT DISAPPOINTMENT, GRANITE HARBOUR.

From a drawing by D. Low.

unexpectedly on their holes nearly buried in snow. Deb and Forde were looking down one to see the thickness of the mushy ice when one leaped out three feet and, as Forde said, 'It nearly frightened a life out of me!'

"Gran had laid the poles up against the floe and left his bag just behind, when the mush gave way and in he went to his waist. He rescued his bag clinging to the pole, and somehow managed to crawl up the ice-foot, but he was pretty wet and soon very cold.

"Deb and Forde sat on their packs by the firmer ice, and I walked along the sea ice (while Gran went along the ice-foot) to the north. We found it all just the same. At every footstep water oozed up, and evidently the floe was melting top and bottom and had never been thick. This doubtful area was forty feet wide. At the north, a quarter of a mile from our track, I managed to get on the ice-foot over three visible cracks, and I don't know how many buried in snow. We returned to the others to find Deb had had one foot through. Having regard to the difficulty of the surface all the way to our camp—eight miles of two-foot soft snow, through which we could only pull the sledge at half a mile an hour with every muscle taut,—I decided it was not safe to stay over on this shore; for a few days' sun would probably convert this mushy belt into open water, and we should have no ready line of retreat at all. So in view of the Owner's lectures on caution and my sledging instructions, I abandoned the idea of camping two or three days on this north side, and we lugubriously determined to push back with our packs to the sledge two miles away. First, however, we had to get Trigger off the ice-foot. I went forward to pick up his bag, and suddenly went through halfway up to my thigh. Luckily the other foot kept firm, and I leant backwards and sat back on the less tricky mush. Then we lashed bag ropes and threw them towards him. He threw the tent poles on to the mush and then launched himself full length on the stuff, gripping the poles. The whole floe rocked up and down like jelly, but the poles kept him up, and he got across to us without further mishap. It would have been impossible to scramble out if we had gone through, for there was nothing firm to grip.

"Forde also volunteered that he thought 'You done a wise thing to give that place a miss.'

"On our way back Deb stopped to take some angles with the plane-table, but found that he'd forgotten his sight-rule, so that even *that* weight was uselessly lugged forward. We camped for lunch at our night camp, and then the sun was so hot that it dried our bags nicely. My feet were very cold and wet, and so were Gran's. I took a complete round of angles both vertical and horizontal, and with the necessary sketching this occupied about two hours.

"Then about four we pulled off for Camp Blizzard and had a diabolical time over the two and a quarter miles of soft snow. The old track was nearly all filled up by a drift from the west, and, though the snow had compacted a little, it was frightfully heavy work. The marks of the bamboos on the sledge floor showed that the whole sledge was resting on the snow. Only off the point of the Tongue did a little of the old track show and helped us somewhat. My sledge belt began to feel as if it was being pulled out through my back, and I had to pull with my hands. We camped about 8 p.m. just near our old Blizzard Camp, where we had to sweep off a foot of soft snow. I went up the Glacier Tongue to get ice, but could not reach real ice and had to go over to a cornice to get air-filled ice. We had an excellent hoosh, four cups of 'Forde's concentrated' with water added. It made a sort of liver jelly when boiled a little more, and I had two cups and a glorious cup of cocoa, cooled so that you could get a good long drink!

". . . And then I gave the diary a miss, hung socks and wet breeches outside the tent, and slept right through till 8 a.m.!"

We pushed off for our headquarters next morning and found we could hardly move the sledge. After struggling a few hundred yards I decided to see how the runners looked. We unpacked everything, and found an irregular lamina of ice about a quarter of an inch thick had coated the runners. This we scraped off with a tin matchbox and then turned the sledge to face the sun, and in about half an hour they were clean and dry. The improvement was most marked, and made our light sledge now only as difficult as the two heavy sledges we had dragged to headquarters! We read in Arctic books that ice is purposely moulded on the sledges, but I expect the temperatures are lower, when that method is useful.

At lunch we had dragged it about a mile and a half, and we dried the runners again. I noted that my amber-coloured glasses had a very pleasing effect; they turned the most gloomy clouds into a beautiful Italian sky. Everything in the heavens is turned into blue and white, which is a great change from the dismal views seen through the green goggles of last year! The relief through using them and the help they give in picking out hollows in the surface is enormous, but they fog up somewhat, of course, with perspiration after a short time.

As we were nearing our headquarters we had a great discussion as to what had happened to the signal flag. Debenham has excellent sight, and with the aid of the glasses he swore that he could see the bamboo lying, broken down. This seemed impossible to me, and I bet him one of our usual 1*s.* 3*d.* dinners that it had not broken! However, after a time I saw myself that the thick and solid bamboo pole had snapped. It was some consolation that his cairn and flag at headquarters had blown down also!.

We had some difficulty crossing the shear cracks near the camp, for the snow had covered everything. I prodded cautiously ahead when we seemed near the largest, and, stepping on, went right in. I had been standing on the exact edge and tested too far off! However, I escaped with a slight wetting, which is the proud privilege of the leader, and we crossed without difficulty.

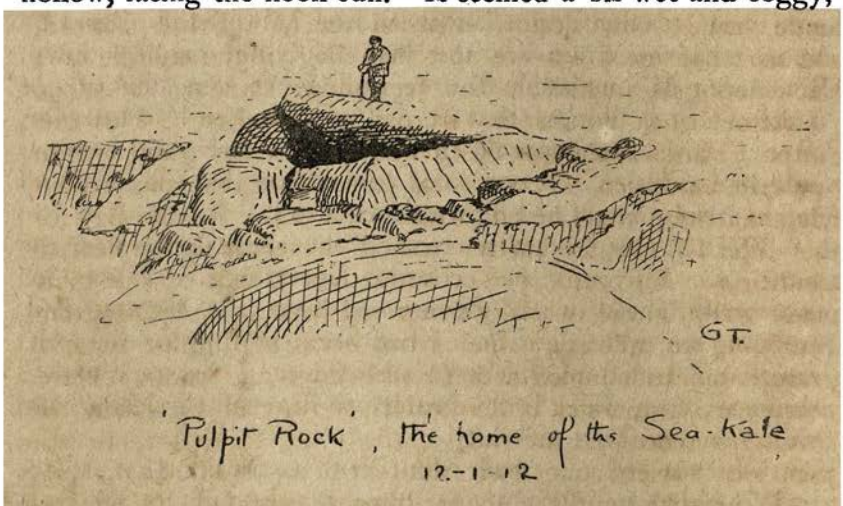
We reached our front door at 6.30, finding that the ice had buckled in our absence, but had not cut us off from shore. Dodging between two pressure ridges we reached the ice-foot amid the huge storm-blocks of ice and unloaded with great joy. Everything was buried in snow.

The 40-lb. biscuit tin was hurled six feet off a rock, and Granite Hut was half filled with snow. We cleared the gravel patch and soon pitched our tent, and had a good hoosh inside us.

Shortly after we turned in it began to blow from the west, a most unusual quarter. This cold plateau wind increased very rapidly, and by 2 a.m. was blowing as hard as any wind I ever felt in a tent. It bent in the stout poles of the tent like whale-bone, and covered the sledge with a huge ridge of hard snow. The door flapped so violently that some of us

could get no sleep. The wind died down about 5 a.m., and the 10th turned out to be a beautiful day. We spent an hour clearing the huge drifts off our sledges, which were completely lost to sight.

As this was Sunday, I decided we would spend it in tidying up our camp. Gran and I planted his sea-kale seed in the evening. He said the Norwegians in Graham Land (West Antarctica) got large crops of this succulent vegetable! I had my doubts, but it seemed worth trying. Behind our camp was a huge cluster of granite rocks enclosing a small cave. We collected some mossy soil and placed it in this hollow, facing the noon sun. It seemed a bit wet and soggy,



but Gran swore the seedlings would be up in a week and edible in a month.

"The skuas are squawking like fussy ducks all round us, sometimes cheeping like young chicks; but they don't lay eggs, which is their main duty now."

All the moss, which formed a regular peaty layer an inch thick in some of the gulleys, implied plenty of soakage. But it was a cold summer, and we never found any drainage when we dug into the hollows. Moreover, the blackened appearance of the moss made me sure that we were not seeing it under favourable or even normal conditions.

A small discomfort, which was to bulk largely in the next few weeks, began to trouble me. During the seal-killing and

flensing I managed to inflict eight cuts on my hands, all of which healed up in the pure Polar air, with one exception. It was on the forefinger of my right hand, and was beginning to fester badly. Gran was our self-constituted doctor, though I'm bound to say that the stories he told of deathbeds which he had attended on Norwegian ships were not at all reassuring. Gravely he felt my pulse and armpit, and then said, "Do you feel pain here?" I truthfully said "No!" "No blood-poisoning in that finger," said he. At any rate it rapidly became worse, and for days I could not write, sketch, or photograph, while the pain prevented my sleeping at night.

The first duty before us was to replace the flag on the rendezvous. Gran decided it should be of a bolder pattern, and so he inserted a white specimen bag in the middle of a black depôt flag, which made a very showy standard indeed.

After lunch we marched across the bay just east of our camp. This washed the beach where the moss grew, and in our exiled position it was natural that Debenham and myself felt that there could be no better name than Botany Bay for this inlet! The ice surface was in a peculiarly unpleasant condition. A frozen layer of snow over a foot of soft snow made walking exceptionally tiring. Flanking the Discovery Bluff—as we called our rendezvous—was a tumbled scree of granite blocks mingled with smaller talus and snow. Here, moreover, numerous little rivulets were rushing down the chimneys scored in the face of the bluff, so that there was plenty of variety about our walk.

We reached our flag sooner than I expected; in fact, we climbed up right above it to nine hundred feet; and had to get down somewhat circuitously, when a hurtling granite block warned us of precipitous cliffs directly beneath. I found that our bamboo was as firm fixed as ever, but it had snapped through like matchwood just at the surface. The wind seemed to have blown *down* the face of the Bluff, which was a most unexpected direction. We mounted it again, after hacking off four feet waste at the bottom. This fragment was to prove very useful to us, for I carried it back to camp.

From this height we could still see nothing but solid ice. By means of the formula—

$$\text{Distance in miles} = \sqrt{\text{Height in feet}}$$

it was possible to get some idea of the distance of the horizon. In this case

$$D = \sqrt{500} = 23 \text{ miles},$$

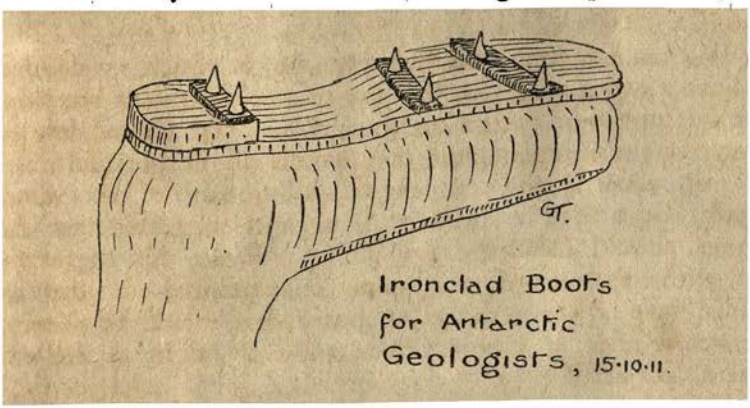
so that the break-up of the ice seemed far enough off. To the north by Point Disappointment I could see the ugly patch of snow-slush which had nearly engulfed Gran and myself.

We had a merry meal that evening, at which we decided to have a sweepstake on the day of the arrival of the ship. But we could not decide on the prize. We wanted lots of things at the moment, but they would all be plentiful when we got aboard, and money was obviously of no value. Finally Gran had a brilliant idea, and suggested that the winner should have the *first bath!* Even this suggestion met with disapproval, for some one pointed out that we should have no clean things on board, and would be sledging for weeks after at Evans Coves, and so might as well not have a bath at all!

Debenham and I continued our discussions on Tennyson and Browning. We both preferred the latter, but Debenham used to try to prove that Tennyson was the better poet. Gran would join in occasionally, and was always ready to give an opinion on some debated stanza of Browning's. "What porridge had John Keats," according to our Norwegian critic, contained an abstruse reference to the gentleman's brains! Poor Forde was out of it in these discussions, and we used to discuss naval matters as a change, for his benefit. But our Irish mate was essentially a man of action, and was as far removed from a facile speaker as any man I've met. "The Bishop orders his Tomb" was a poem which had a fascination for me. Many a weary mile has passed unnoticed, while I have memorized line after line of that somewhat lugubrious poem.

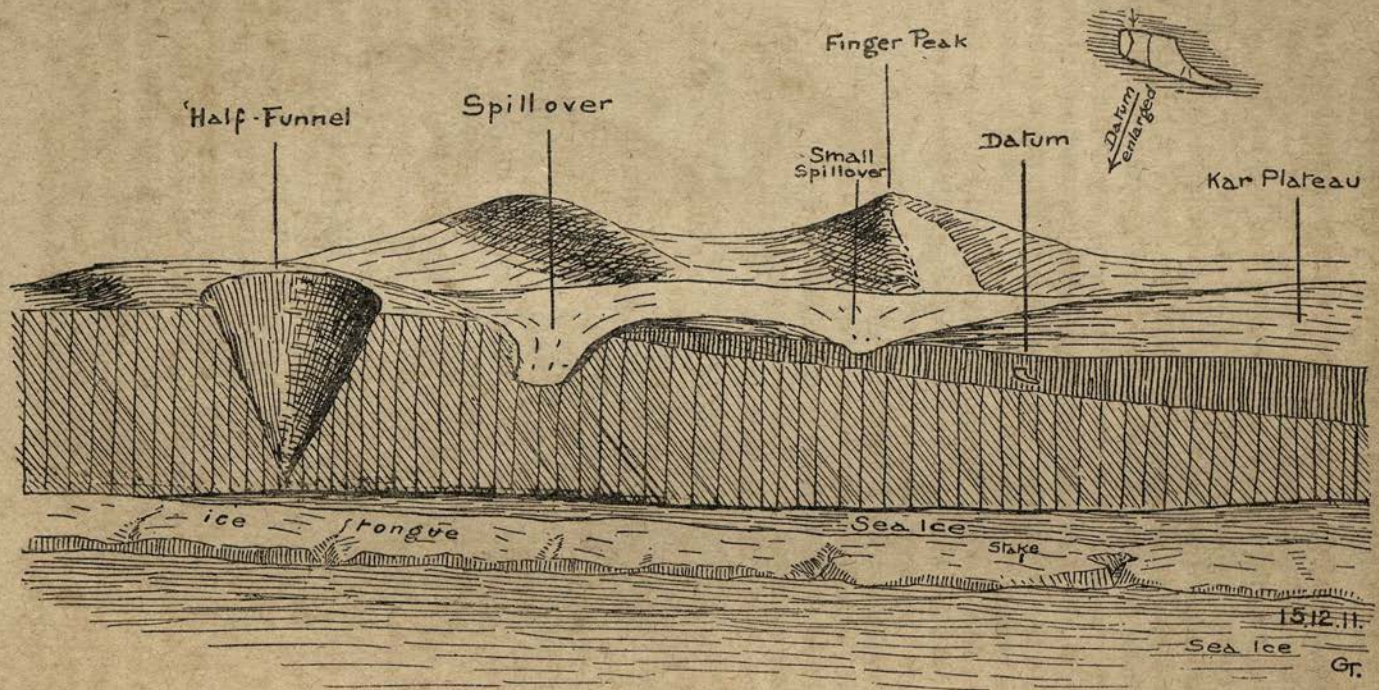
On the 12th Gran found two skua eggs. The poor mothers seemed wet and miserable, and Gran affirmed that the second was sitting in a nest full of water, and seemed relieved to be free of her charge. We collected a few every day from now onward. They are smaller than a hen's egg, and of a brown colour, with irregular black, tawny and buff flecks irregularly scattered over the shell.

On this expedition we had more of the trouble with boots which we had experienced early in the year. My "iron-clads" had lasted splendidly. The steel spikes and bars had protected the leather completely, and only on the 14th did the first bar break off. For future work of this description I should certainly use the heaviest and largest Alpine boots, and



that is the most valuable advice as to equipment that I can offer to future Antarctic geologists.

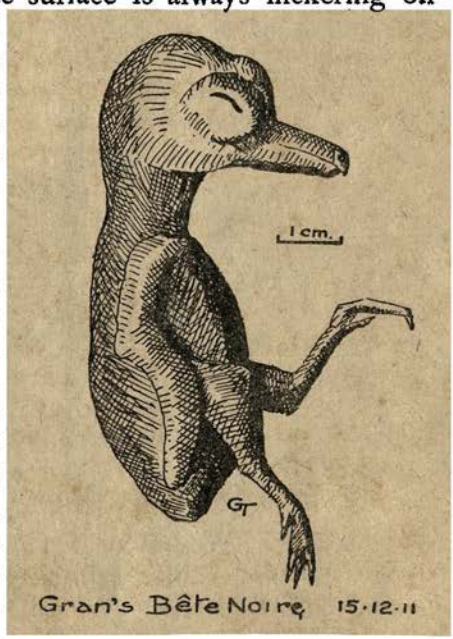
I had been busy planning how to measure the velocity of the Mackay Tongue. This flowed eastward between us and the Kar Plateau, so that by sighting from our granite cape to a fixed point on the Kar Plateau cliffs, I could fix very accurately a datum line. It only remained to plant a mark on the moving glacier somewhere on this line, and our investigation would be well started. Unfortunately we had nothing for a mark. I thought of placing a seal carcase on the glacier; for stones would sink into the ice in a very short time. Finally I used the butt end of the flag-pole from the Discovery Bluff. Here at last we found the blubber-soot useful, for I used it as a paint to increase the visibility of a swab of sealskin which I bound on the bamboo stake. Gran and I marched across to the Tongue carrying the stake and the theodolite. I never remember any hotter walk than that two miles. The sun simply made the perspiration pour off us! However, one could always sit down and have *glace au naturel* to cool one. Personally, I never felt any ill result from eating snow in the Antarctic, and all our party quenched their thirst in this way.



Looking north-west from Cape Geology, showing the granite cliffs of the Kar Plateau (1000 feet) capped by dolerite. The latter enclosed the granite "datum" whereby the movement of the Mackay Tongue was measured.

We climbed up the Tongue without difficulty, but soon entered into a region riddled with crevasses. They were parallel to the edge of the tongue, and looked like relics of old lateral pressure rather than crevasses due to present movement. They were difficult to cross, especially as Gran's boots were so slippery. We had to make a big détour to get on to the transit line. Finally, I got the theodolite set up, and sighted "fore and back," until I got the cape and a crack in the Kar Cliffs in transit with my station. Here we planted the stake, and then returned *viâ* the maze of crevasses to the camp.

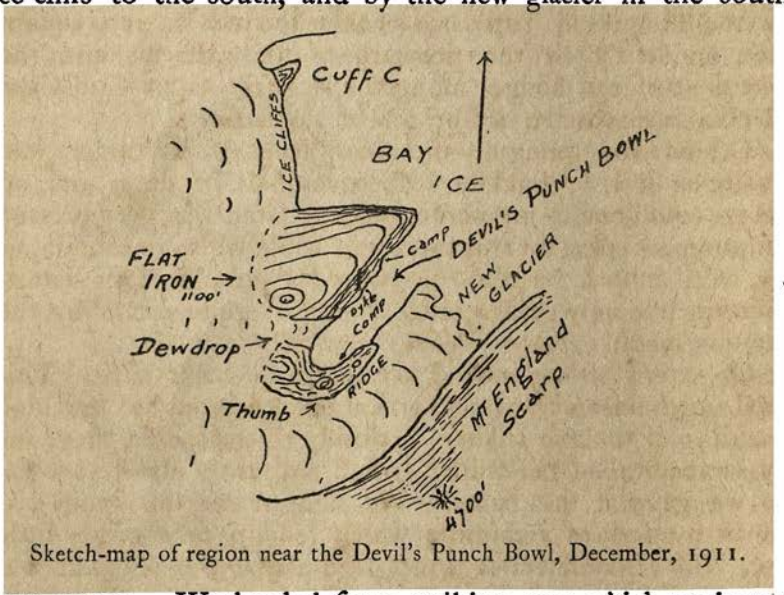
At first I could hardly see the stake from Cape Geology. The cold air close to the ice surface is always flickering on a warm day and mirages all objects; but soon I made it out at two miles through the telescope, and I could see that we could readily measure a movement of one foot a day.



By this time we had collected enough eggs to have a feast. We took the precaution of frying them, and Forde and I tested them before cooking. The whites are translucent and faintly bluish, and have very little taste, but I don't think we had much fault to find with them. It was amusing to see Gran's horror when a twelve-day chicken appeared in one of the eggs. It was really an interesting discovery, for it showed that the skuas commenced laying about the 4th of December. We could not preserve the specimen, but I knew Dr. "Bill" would be interested, and so I made a sketch of Gran's *bête noire*. We had a splendid seal-hoosh, tender, and flavoured with onion-powder, and on top of this was a fried egg for each of us. It was Forde's *chef d'œuvre*, and celebrated the close of his week of cooking.

For the purpose of my survey I laid out a base-line about a mile long on the bay ice. From the known length of this, as measured by the sledge-meter, and angles from the two ends it was, of course, possible to determine the distance of any visible point. Each of these three points forms a station to which others may be linked ; and indeed, in exactly this manner is a "triangulation" carried out.

On the 16th we started off to examine and survey the western coast of the harbour. Here the Mackay Glacier entered the sea, chiefly by the great tongue, but also by huge ice cliffs to the south, and by the new glacier in the south-



Sketch-map of region near the Devil's Punch Bowl, December, 1911.

west corner. We headed for a striking cape which projected from the glacier like a black hand stretched forth from a snowy cuff of glacier. We called this promontory Cuff Cape.

My finger was very painful, and the swelling now extended right through my right hand. Luckily I could pull in harness as well as ever, but for many nights I had no sleep, and I could do little or nothing in the way of making records during the day.

However, I became a fairly expert writer with my left hand in the course of time, but it was very galling to be incapacitated in almost the most interesting part of our journey.

We camped on the ice-foot at Cuff Cape and scrambled up to see the glacier behind. Like all the land hereabouts the rock was covered with a layer of jumbled blocks of granite mixed up with gravel and clay. The ice cliff was fifty feet high, and almost free from silt or rock. Hence the debris on the cape surely marks the condition of the land prior to the last advance of the glaciers. It is not rock crumbled *in situ*, for I am sure that would be more in the form of a gravel—moreover, erratics were common.

There was, of course, some moraine material, and a few perched blocks especially along the north shore. In the bay near the Tongue the latter had broken the bay ice into square cakes, evidently by the pressure of the glacier; and the movement of the Tongue along the stagnant ice of Cuff Cape had piled a rampart of ice on top of the latter.

The hot sun acting on the ebony front of my camera had actually split it! Luckily I discovered it in time, and no damage was done to my photographs. Gran was very pleased at finding an insect on this cape, and while we were examining this wild animal, he also discovered "gold." This latter, however, was only golden mica, though it quite resembled the precious metal.

On the 18th we moved across to the next cape. This stood out boldly with nearly vertical crags a thousand feet high bounding it on two sides. It closely resembled in shape the sky-scraper called the "Flat Iron," and as it also had a flat top we gave it that name. We camped on the south-east side at the foot of a chimney which led up to a pretty little tarn. The summit was 1200 feet above the sea and was covered with a wonderful variety of rocks.

Looking up the glacier to the west we could see a plateau of dead ice. The moving glacier split on Mount Suess, and the greater part of the ice entered the sea as the Mackay Tongue. A small amount flowed down just south of the Flat Iron forming the "New Glacier" (see map, p. 376). In my opinion there is a tendency for greater erosion at the edge of the ice, for here the sapping action in the "lateral moat" is very active. In the centre of a glacier the only erosion is that due to glacier planation, and as I have explained, very little of this is taking place in Antarctica at present.

There was a marked descent from the top of the Flat

Iron to the snow plateau, and then a steep drop into the "Devil's Punchbowl." The latter was a fascinating spot, and on the 20th we shifted camp so as to examine it more closely.

We were encamped on a small beach beneath the rocky wall of the new glacier, which we called the "Devil's Ridge." Probably the state of my finger accounted for His Satanic Majesty's frequent presence on the map hereabouts. The Punch Bowl was an empty cwm or bowl-valley, which had been eaten into the steep southern edge of the Flat Iron. Its floor was below sea-level, and it would thus appear to indicate subsidence, for we have no idea how the accepted methods of eroding cwms (by "thaw and freeze" chiefly) could act *under* water. The New Glacier had very lately ceased to fall over the Devil's Ridge into the cwm. It is only six feet below the ridge, and there is a drop of five hundred feet to the floor of the latter. In fact, thaw waters still cross the ridge and flow through the debris and down into the cwm. It is perfectly obvious that very little power is exercised by the "New Glacier," or it would have swept the Punch Bowl out of existence.

There was a little tarn held back by a large bank of snow near the top of the ridge, and here Gran celebrated midsummer by a bathe! I envied him, but could not follow suit owing to my disabled hand.

Across the bowl a small hanging glacier entered the cwm but did not reach the sea ice below. We called this the Dewdrop Glacier. It terminated in a rhomb-shaped face which was three hundred feet above the bay. In the bay itself was a great thickness of ice, and Debenham and myself had many arguments as to its origin. He believed it was an ancient relic of the Dewdrop Glacier; but I inclined to the belief that it represented old floe ice jammed up the narrow bowl by sea ice from without. Gran and I ran a line of levels across it with the theodolite, which showed that it was still afloat although in places it rose many feet above the bay level.

We were running short of stores, so Gran and I marched back to our headquarters. While I collected the stores he looked around for skua eggs and soon found eight. The sea kale did not show that verdant growth which Gran had

anticipated. However, he dug up one corner of the "garden" and proudly showed me that one of the seeds was sprouting!

Gran put the eggs in a tin to carry them to the Punch Bowl. For security he carefully packed them; but as the tin was black and the sun was hot his packing, consisting of snow, soon vanished! However, we got the eggs safely to the others. Unfortunately five were bad, but the others assisted the menu at our midsummer feast.

On the 22nd Gran and I explored the ridge and examined the Devil's Thumb. This knob is eight hundred feet above the bowl and is composed of granite stiffened by porphyry dykes. Next day we spent some time examining a huge enclosure of limestone caught up in the rocks forming the Flat Iron. The crumpling and heat had turned the limestone into marble, and along the junction with the granite many unusual minerals had been formed. There were huge brown augites several inches long, and large masses of natrolite, tremolite, and other similar minerals, which filled Debenham's petrological soul with joy.

We returned to Cape Geology on the 23rd of December. In our absence the tide crack and pressure ridges had been torn wider by the pressure of the Mackay Tongue on the sea ice. However, we got ashore without much difficulty by zigzagging along the torn edges of the crack (see p. 369).

We found the floor of the hut inches deep in ice, which Forde cleared out with the ice-axe. Meanwhile Gran was busy at the medical chest, where the long names rather confused him. However, he seemed to remember "aspirin" as a useful friend, and said it was suited to my case. I swallowed some of the tabloids. Then he came across "salicylate," and apologetically remarked that the latter was what he had been thinking of. So I tried them also. I was of the opinion myself that my trouble was a combination of frostbite, blood-poisoning and rheumatism, due primarily to an infected cut, and later to cold and a diet of seal meat. However, on return to civilization I was assured that I ought to have had my finger cut off, and that the bone had been affected. Gran very willingly started operating on it with a lancet; but I am thankful to say that I distrusted his powers as a surgeon, with the result that now all is well.

On Christmas Day we roamed about Cape Geology

collecting specimens and skua eggs. I was pleased to see signs of intellect in two of the skuas, for my observations of seals, penguins, and skuas left me convinced of their stupidity. However, in one nest the bird had dragged some moss from a patch a foot distant, and in another case some quill feathers were arranged around the nest. All the other birds nested anyhow and anywhere. A gully, where water often trickled down on a specially hot day, was a favoured spot!

For lunch we cracked twenty-seven eggs, of which eight were edible. Then we opened the Christmas bag and we found therein a small pudding ready cooked and some caramels and ginger. Forde had rigged up the flap again, and had raised the Irish flag on his own behalf. He cut out a white harp from a linen specimen bag and sewed it on to a piece of green burberry. The result was patriotic and striking. Gran's sledge flag was a beautiful piece of embroidery presented by Queen Maud, and contained the Norwegian arms. Debenham's and mine bore the arms of our universities.

I had carved a spoon out of a piece of bamboo from the broken end of our depôt flag, and Debenham used this as a lever to photograph our group. This primitive arrangement took a lot of fixing, but he obtained quite a successful picture finally.

A heavy sea fog rolled up that evening, and most of us suffered from rheumatic pains. As a rule, we never caught cold while sledging, though I remember a touch of influenza on one occasion. This freedom from some of the minor ills of life speaks well for the purity of the air in the Antarctic.

Debenham's birthday is the 26th of December, and Gran had remembered this fact and carried a packet of cigarettes from Cape Evans as a present to him.

We walked along the flank of Mount England to explore the New Glacier and to find a track to the Upper Mackay. Numerous couloirs or chimneys grooved the steep face, and Gran and I climbed four hundred feet up one of them. The snow-line was about eight hundred feet up, and below this was a tumbled pile of debris and granite blocks with a little water running between. It was obvious that frost action was now leading to a great deal of erosion; while at the head of the couloir where the snow lay, less action was taking

THE FIRST WESTERN PARTY IN A NATURAL ICE-TUNNEL AMID THE PINNACLES OF THE KOETTLITZ GLACIER.

Edgar Evans standing.

THE SECOND WESTERN PARTY AT CAPE GEOLOGY, GRANITE HARBOUR, ON CHRISTMAS DAY, 1911.

Forde and Gran standing, Debenham and Taylor sitting.

place. In short, true glacier erosion (planation) was absent, and yet all round were specimens of cwms in all stages of their evolution. Here a gully, there a couloir somewhat deeper, on the Kar Cliffs a couloir cut into a "half funnel" (p. 374); at the "Spillover" near by, a small bowl at the back of the eroded notch, and along the mountain ridge (named later after Gonville and Caius College), a series of giant cwms which, in my opinion, originated in some small gully such as that I had just climbed. At the foot of each of these deep couloirs was a delta or debris fan.

We climbed up the steep face of the New Glacier just where it joined the talus of the mountain slope. Higher up was a deep lateral gully which had been dammed by debris, and contained a lake about a quarter of a mile long. This was bounded by steep granite cliffs on the south, which showed no sign of grooving by the glacier, but was breaking off in "shells" owing to frost action.

We could see up the New Glacier, which was badly crevassed in many places. I came round to the opinion of Debenham and Gran, that it would be wiser to portage all our gear up the 1000-feet cliffs of the Flat Iron, and so gain the quiet area behind the latter. We returned to Cape Geology, and packed a fortnight's provisions and gear for our journey up the Mackay Glacier.

I caught many of the insects I had discovered on arriving at Cape Geology. Indeed, later Debenham found them under most of the stones, clustering among the whitish roots or hyphæ of the moss. They would be frozen stiff in a thin film of ice until one turned the stone into the sun. Then the ice would melt, and they would move sluggishly about until the sun left them, when their damp habitation froze again! I cannot imagine a finer example of hibernation, for it looked as if they pursued an active life only when a beneficent explorer let in a little sunlight on them! Debenham detected a little red species which was much more nimble than the millimetre-long blue ones, and I had much trouble in catching six of them; but the others were more easily managed. I smeared a piece of paper with seccotine, and then, taking a small brush from the medical outfit, I brushed them by hundreds on to the paper. "Seccotine sticks everything," and the *aptera* were no exception. In a few moments they

were securely embalmed like the flies in amber, and so we safely carried a thousand of these unknown insects back to civilization.

At noon on the 27th we arrived at the foot of the Flat Iron again, and started our big task. Like most premeditated ills, it was not so difficult as anticipated. First we had some tea on a little gravelly ledge about a hundred feet up, and then packed the gear for transport up the mile of angular granite blocks which lay between us and the top of the Flat Iron. Forde and Gran carried the sledge on their shoulders, and, as may be imagined, had a most uncomfortable journey with this "old man of the ice" to handicap their scramble. Debenham and I carried food and gear, and in about a dozen journeys everything was perched high up on the Flat Iron's summit. Open water was visible from five hundred feet, so that it was still about twenty-five miles away. Pennell had not much chance of reaching the rendezvous unless the ice went out at a mile a day.

We left our snug gravel island next day, and knotted ourselves well to the sledge. We were now to journey for some days over the Mackay Glacier, and though we naturally chose the smoothest and least disturbed ice for our route, yet we had to pass near areas full of huge crevasses. I had less anxiety than ever to fall into one, for I could not use my right hand at all yet. However, the other three were almost too prompt to pull me out, as I realized a week or two later.

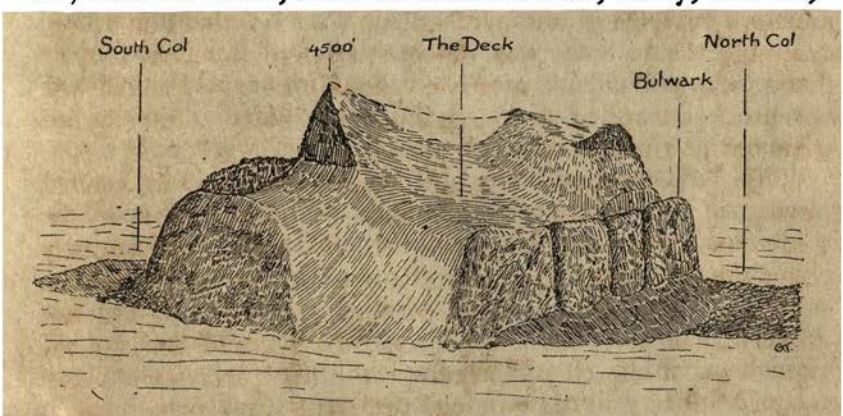
We zigzagged down on the snow plateau. This is about ten miles wide, and seven miles from east to west. It is bounded by the New Glacier crevasses on the south, and by rock islands which we called Redcliff and Mount Suess on the west, by the chaos of the Mackay Skauk on the north, and by the Flat Iron and Cuff Cape Glaciers to the east, where there is a 1000-feet drop into Granite Harbour.

"The surface was covered with deep snow; we don't know what is beneath. There are many indications of east-west depressions in the snow into which we fell occasionally, but I am not sure if they were crevasses. The surface often fell in with a widespread sigh, which was eerie but harmless.

"To the south is a wonderful series of peaks about five thousand feet high, forming a wall of giant cwms. Probably they form the divide from the next great valley (of the

Debenham Glacier). Quite a number of these peaks show a recurved spine on the summit, which is probably due to the weathering of dolerite crags. To the north-west is a mountain approaching seven thousand feet, which is capped by dolerite lava." (We called it Black-cap at first, but it is now officially known as Mount Tryggve Gran, after our ever-cheerful comrade.) "In the face of this mountain are faulted white bands which are probably Beacon Sandstone."

That evening we camped on Redcliff *Nunakol.* This latter term I invented with Gran's assistance to describe a rock island resembling a *nunatak*, but rounded by previous glacial erosion. The nunatak has properly never been below the ice; hence its name, from the Icelandic *nuna*, lonely, and *tak*,



Mount Suess Nunatak, looking west from Redcliff, December 29, 1912.

a jagged peak. Nunakol is from *nuna*, lonely, and *kol*, a rounded ridge.

We placed the tent on a patch of gravel near to a little waterfall. I followed up this stream, and found that it rose in some swampy ground where a little moss was growing. Next morning we all explored the Nunakol, which was 1080 feet above the glacier. The top was more or less flat, and as usual consisted of granite covered with much debris. I managed to do some sketching, and was especially interested in the numerous pot-holes cut out in granite by the wind. They were about a foot in diameter and eight inches deep, and each contained some pebbles by which they had been scoured out.

To assist our survey we named many of the peaks and glaciers around us. The sharp peak to the north (which I usually made the datum for the theodolite angles) we called the "Referring Facet." A large tributary glacier to the east of this was named the Cleveland Glacier by Debenham. He explained that it was after a large family, and so required a correspondingly large natural feature! Red Ridge was to the south, and formed of red granite. Killer Ridge had the shape of an *orca*, Sperm Bluff was a black headland like the blunt head of the sperm whale. Pegtop and Dome nunataks are self-explanatory. We were quite close to Mount Suess, and obtained a fine view of this nunatak. Its three dolerite peaks, the armchair hollow, and the bulwark on the north-east, supported by huge granite cliffs, made it a very striking object.

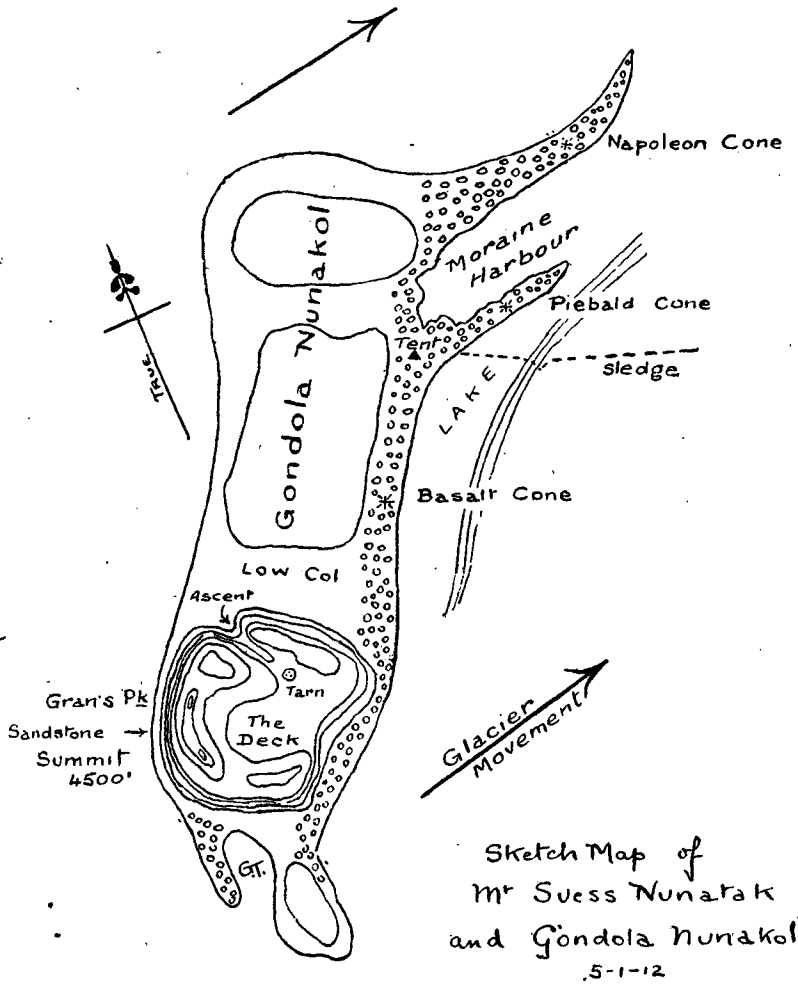
On the 30th the day was overcast, and it snowed most of the time. We could not leave the tent, and lay snug in our bags and mended gear. I did some useful darning, using seaming twine to repair my socks. They were lasting splendidly. "I mended them with my left hand; so far I am still wearing the same socks for eight weeks. If I could darn easily, I'd keep to them for our whole fourteen weeks. . . ." Such was the practical value of my patent canvas heel-tips!

Debenham and I made a set of chess pieces from cardboard, and we played on his survey plane-table. It took a week or two to get used to the men, but we had many games later while we were marooned on Cape Roberts.

On the last day of the year we pulled westward to Gondola Ridge. "All was snow-covered, and we sank four inches into it, but the sledge pulled pretty well. There was no sun, but I got in a cold sweat with the work. Now and again our feet would sink a foot or two. There must be plenty of crevasses round this corner of the nunakol, but we trusted the fates and plugged on. The snow was so deep that we did not break through the bridges anywhere. The sun came out to cheer us, and soon we heard the old creaking due to 'bottle-glass' ice and 'glass-house' ice. . . ." I knew this meant an ancient undisturbed glacier from our experience up the Koettlitz Glacier, and felt that we were safely past the crevasses.

About noon we had approached close to Gondola Ridge, which extends northward from Mount Suess. Here we came to a sudden ice cliff, but the slope was not too steep for us to

toboggan down it on to a lake surface fringing the moraines. I expect thaw waters had cut out the cliff. Here were fine debris cones just like those of Cape Evans, but larger, and



formed not only of dolerite, but of granite and Beacon Sandstone.

"We pushed on for a whitish silt-bank, and then left the sledge near it among the black and white rocks composing the moraine. The silt-bank was a huge heap like a railway embankment. It was twenty feet high, and composed of

Beacon Sandstone debris. A little lake lay at the foot, and its flat top made a splendid camp site. 'Here, on soil formed of real sand, like that near Sydney, we pitched our tent:'—probably the first time such a thing had been done in Victoria Land. We found a bounteous water-supply by cutting through the ice of the little lake, for alongside a big black boulder the radiation of the sun's heat had melted the ice. This was a great saving, for none of our precious oil was now wasted in melting the ice."

There was an extraordinary mixture of dolerite and sandstone all over the Gondola Ridge. The sandstone was characterized by blebs, which in Germany would be called "Knoten." We called it briefly "smallpoxy," and it did not look hopeful for fossils. However, there was some shale near the tent, which looked more hopeful. We did not find much beyond worm-casts and ripple-marks at first.

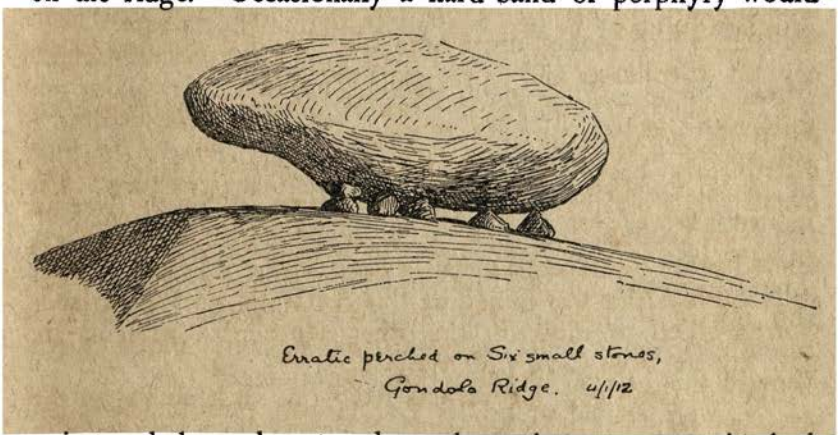
The discovery of fossils was of especial importance to Australia, because the central Antarctic area had served as a distributing base for Australian animals and plants. The marsupials are represented by a few forms in South America and New Guinea, and there seems little doubt that land extended more or less continuously between these limits. Earlier still South Africa was joined to this Antarctic world, for land-worms allied to those in the other southern continents are now known from Cape Colony.

When Gran and I returned from our first survey of the ridge we found that Debenham had already been successful in the shales. He had found some vesicular horny plates. I turned to, and soon obtained two large pieces like the red tiles capping a roof-ridge. They were nearly two inches long, and had a well-marked keel. There were also smaller complete plates. On our return to Europe these were identified as the armour-plate of primitive fish, and probably of Devonian age. So that our find on Gondola Ridge added a new epoch to Antarctic fossils, for Cambrian limestones were known, and Permian coal-measures were indicated by Shackleton's specimens. These fish plates identified another set of sediments midway between them.

The moraines near our camp, though by no means so abundant as on a smaller European glacier, were the most important which I saw actually on a glacier in the Antarctic.

To the north-east two medial moraines stretched out from the ridge and enclosed an area which we called the Harbour (see p. 391). In a warm summer this is probably a lake. One striking "piebald" debris cone was half white and half black. It was twenty-five feet high, and the eastern portion had resulted from the weathering of a huge "erratic" of sandstone, while a similar mass of dolerite had broken up to form the western half of the heap.

Even so far up and away from the sea we found some lichens. These diminutive plants were busily etching the surface of the granite just as in more clement climes. Beautiful rounded and polished platforms were quite abundant on the ridge. Occasionally a hard band of porphyry would



project and show almost a glaze where the coarser granite had been weathered and dulled.

We could now see uninterruptedly to the great ice plateau. Only one nunatak lay between us and the outlet ice-falls near Mount Gran. We saw many examples of perched blocks, some being deposited on top of polished faces of granite. One huge block, which I sketched, had been lowered gently by the ice on to four "legs," at one corner composed of two small stones. Between Mount Suess and Gondola Ridge was a definite "col" or low pass containing small tarns and covered with debris. We returned to the camp by this route, and had no difficulty in clambering down its eastern outlet.

The 2nd of January was a cold gloomy morning. The clouds settled down and swathed everything in a clammy

mantle. I dared not move far from the tent, and so we broke up shales and collected more of what Evans called "sarpent critters." I found a few brilliant blue plates with a lustre like that on the elytræ of beetles! I walked over the north end of the ridge where the solid granite was broken into large "bricks" separated by several inches. These blocks seemed to have moved to the east, and this movement may be due to glacier "plucking"; but I think it is merely the result of frost cleavage followed later by rock "creep." At any rate it was very common on the "floors" left by the recession of the ice-sheet.

Debenham in his prowl for specimens had discovered a coal-mine! In this case it was not a large one, and consisted of a fine lump of brown coal about four inches across.

On the 3rd Gran and I determined to circumnavigate Mount Suess. This most striking mountain lay about one mile south of us. It towered 3000 feet above Gondola ridge and was a most impressive sight. The upper layer consisted of black dolerite, largely showing columnar structure. The main mass was formed of reddish granite. It stood out four-square like some gigantic castle keep (see Fig., p. 383). The centre was hollowed out and three cusps or peaks rose at the north, west, and south angles respectively. In fact, it resembled more than anything an ancient molar tooth, though this parallel libels its rugged grandeur.

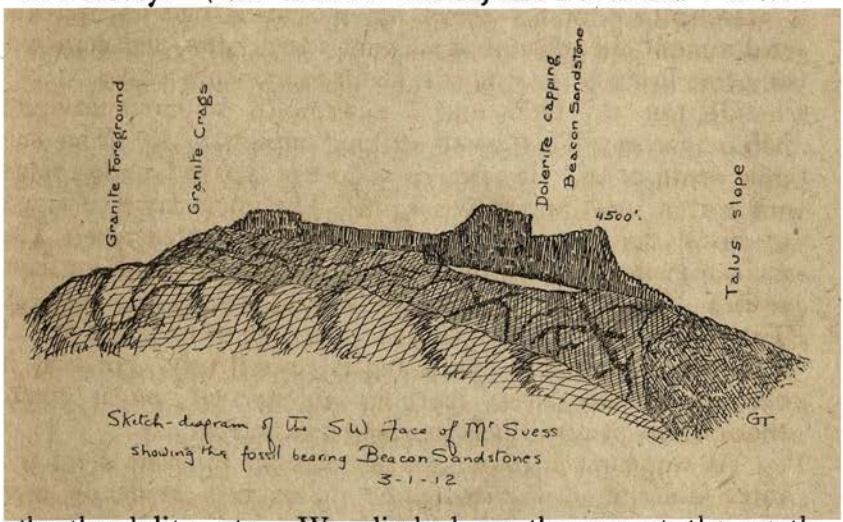
As we marched round its east face we came on more and more dolerite in the moraine. This had evidently been swept round the south of the mount, and as this moraine contained the sandstone fossils it was very important to see where the moraine originated. Between the mount and the glacier to the south was a low col of granite from which talus debris reached upwards almost to the dolerite cap. The mount itself looked yellow, but I found this was due to a yellow tint in the granite.

The sky was clouding, and we had still a long way to go. So we hurried round to the west side of the mount, and here I saw what I had expected, that between the granite base and the dolerite capping there was a long "lenticle" of yellow sediments. It was, however, quite inaccessible from below, and after making a sketch we marched on the north. On this side there was very little talus. We clambered along over

granite terraces some 300 feet above the glacier. We crossed the top of the north col without difficulty and proceeded over Gondola Ridge to the tent. Later, Debenham and Forde appeared. They had found an easy route to the central hollow of the mount, which we called "The Deck," but had not had time to ascend one of the peaks.

On the 4th the morning was clear, and I felt that we could not do better than get the theodolite on the top of Mount Suess, and so connect up many of the distant peaks with our survey.

Debenham decided to stay below and continue his plane-table survey. Gran took his camera, and Forde and I carried



the theodolite, etc. We climbed up the gap at the north corner, and then scrambled along a slope full of snow-covered boulders which lay between the main peaks and the 1800-feet Rampart. This latter feature seemed as if pierced for guns also! Possibly the gap and the "ports" were due to the weathering away of volcanic dykes in the granite. They did not look as if ice had cut them out. Where the gap emerged on the "Deck" were two little tarns at about 1200 feet above the tent.

Gran proceeded to climb the central-west cusp of the mount, thinking it the highest. Forde and I attacked the south-west peak. The slope was very steep and covered at first with grey granite, black dolerite, and yellow sandstone

blocks. At 2000 feet only the dolerite blocks were seen, so that I feel sure that the sandstone crops out *inside* the hollow of the mount (between the granite and dolerite) as well as on its western face.

At 1.40 I reached the top and found that it was 3000 feet above the tent. I set up the theodolite and obtained a fine series of angles. Sighting on Gran's peak, which he had just surmounted, I found it was two degrees lower, which I estimated at about a hundred feet, whereat he was somewhat crestfallen. However, he walked across after obtaining a splendid set of photos of the landscape spread out before us. The actual summit was fairly flat for a few yards, with a thousand-feet precipice on the south and west. Far out to sea we could see miles of open water, especially to the south, with floes drifting in it, but it did not seem much nearer than a month ago.

To the south a deep fiord-like valley seemed to pierce right through the Gonville Range. It was of course filled with ice, and was, I think, what the Americans call a transection glacier. Probably it connected the Mackay Glacier with the Debenham Glacier. The cliffs at its west portal were cut into giant "forts," and bands of beacon sandstone showed clearly enough above the granite.

To the south lay the Sperm nunakol. It was only a mile away, and we seemed to be right over it. It showed a flat surface covered with debris much like the Flat Iron. The Peg Top nunakol seemed to have lost its knob-like appearance. It was somewhat T-shaped, the front bar rising like a crocodile's head from the covering of ice. To the south of this rock island there seemed an easy route up to the Plateau —good enough for ponies, if the first step up to the "Flat Iron" could be negotiated.

A very high mountain, possibly 10,000 feet, showed to the west. We could not estimate its distance properly, for all our survey angles to it were so acute.

After spending two and a half hours on the summit we hurried back to the camp, and found that Debenham had passed a useful if uneventful day.

On the 6th of January we took down the tent and transported our gear across the rugged moraines to the sledge. While I was packing the fish scales in cotton-wool, the other

Gondola Ridge from the top of Mount Suess, looking north-east, January 4, 1912, showing the "deck," ramparts, and medial moraines.

three had found more coal near the sledge, and they soon collected five specimen bags full. It was undoubtedly derived from Beacon Sandstone beds close to our camp, and possibly from the outcrop we had seen on Mount Suess.

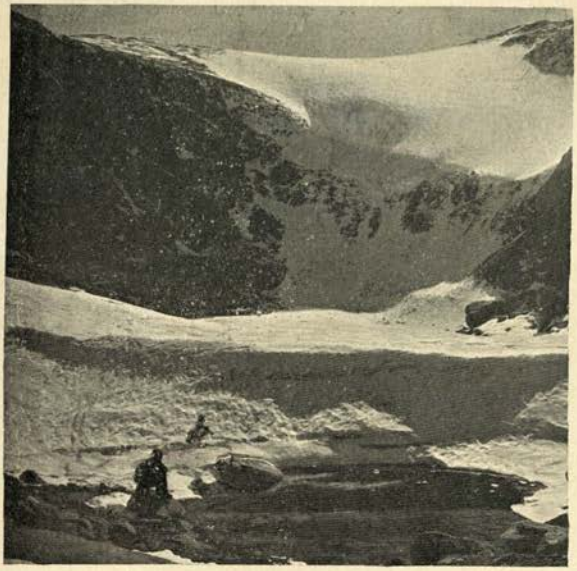
We marched straight back to the Flat Iron, camping for lunch about halfway. It was interesting to note the way the snow lay in various regions. Small cwm valleys at low levels were filled with snow and ice, while large plains at higher elevations to the west were seen to be almost bare. Perhaps the snowfall varies with height, while the ablation (evaporation) may depend largely on the wind direction.

Next day we devoted to a survey of the Flat Iron. I went to the northern face to see if we could drag or lower the sledge down the glacier without unloading it. I had a light camera and was able to take a few interesting photographs. The first looking over Cuff Cape to the north illustrated the following physiographic features: the ice-face, crevasses, skauk, young calf-bergs, moraines, retreating glacier, granite pavements, shear-cracks in bay-ice, the ice tongue, facets on the cliffs, cwms, overflows, hog-bag ridges, the junction of the granite and dolerite, and the Kar Plateau—all on one quarter-plate negative!

To the south was the small tarn I have mentioned earlier. The furrowed face of Mount England was reflected in its still water, and a solitary skua gull was preening his feathers on a boulder in the lake. I managed to get a successful photo here also.

Meanwhile a sea-fog was rolling in from the east. Gradually it blotted out all the features below us. I had just time to hurry back to the tent before everything around us vanished. Debenham turned up a minute or two later, but I was getting anxious when Forde and Gran returned. It is impossible to find one's way in these fogs, and exposure to Antarctic weather is a thing to be dreaded even in summer.

Next morning we started transporting our gear down to the bay-ice. We followed our former route, which certainly seemed to have been the best. We had now to carry down many specimens, for the Flat Iron was a wonderful collecting ground. The main mass is grey granite, but it includes many varieties of schist and bands of altered limestone; gabbros, amphibolites, quartz porphyries, marble, mica-schists, felsites



GRAN'S MIDSUMMER BATH, DEC. 21, 1911.

A small tarn of the Devil's Ridge overlooking the Punchbowl (300 feet below). Across the latter appears the Dewdrop Glacier. The tarn is held back by a snow-drift glacieret. [See p. 378.

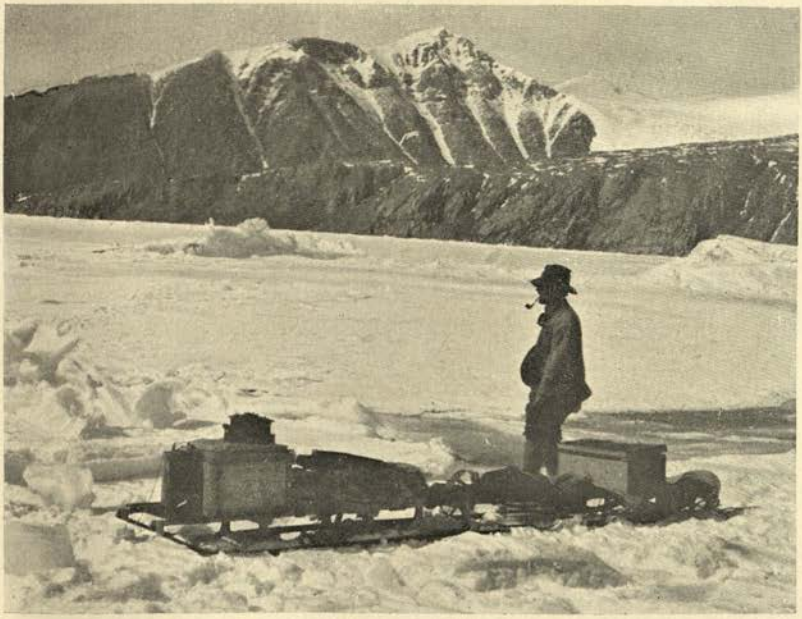


Photo by Gran.]

THE COULOIRS OF MOUNT ENGLAND (WHICH DEVELOP INTO CWMS LATER).

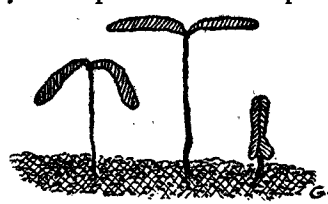
The Flat Iron hides the base of the mountains. In the foreground the ice-foot of Cuff Cape.

and rhyolites were mostly *in situ*, while erratics of basalt and sandstone were common.

The rough shaking to which our gear was subjected resulted in our losing the top of the theodolite tripod, the pump-knob on the Primus, and the sight-ruler! Debenham found the latter, but we had to use makeshifts for the other lost articles.

At 7 p.m. we were back at Cape Geology. Each time we returned we found the pressure ridges and tide crack off the cape had altered in shape and made our approach more difficult. The skua gulls had found our blubber store and were gobbling it up as rapidly as they were able. Our hut floor was inches thick in ice, but we gave up trying to make the hut comfortable, and the cook shivered out there at the stove, and then brought the food down to the tent, where we ate it in comfort.

At this time we were devoutedly hoping for wind, so that some of the sea-ice should blow away and permit the ship to reach us. Captain Pennell was due any day now, but the bay-ice looked as solid as when we had entered in November.



We inspected the "vegetable garden" and found that twelve dicotyledons had sprouted! I imagine these are the first grown in the open air within the Antarctic circle! They seemed thirsty, so I gave them some water. But, alas! the weather rapidly grew colder. Every day a few were blighted, and, finally, I carefully gathered the remnants and placed them in my pocket-book as a record of Gran's well-meant experiment.

I was much disappointed with the moss. It lay in peaty clods between the boulders, usually in lumps about the size of a large bath bun, and had formed a considerable amount of humus. But it remained almost black and dead all this summer. Usually January 15th is the warmest day, but this season December was much warmer than January, and I think the backward condition of the moss showed that it was an exceptionally severe summer.

I was now cook again, and will copy some of my cooking

notes. "At 4.30 I dug up the seal-meat cache, and found a whole liver buried deep under a layer of ice. It all seemed fresh, and Forde helped me to cut it up on a board outside the hut. Then I got the stove lighted by blubbery paper pretty easily, and the cooker full of water. I heated this for cocoa till it began to sing, and then put on the frying-tray. This latter was the base of our cooker, but served excellently as a pan; except that it was so large that one part of the meat would freeze while the rest was frying! I put in some fat, and tipped in four mugs of cut up seal and liver. It took about three-quarters of an hour to cook, being stirred continuously. I fear me I used my dagger as poker, cutter of blubber, as scraper of soot, stirrer and taster, all indiscriminately! However, with onion powder and salt it doesn't taste badly, though it makes my teeth ache chewing it. The cooker of warmed water boiled in no time, though it had been cooling for three-quarters of an hour, and we had hot cocoa to time. I had only one biscuit, so that it was a cheap indigenous meal."

The weather had been rather disagreeable during the last month, about four days fine alternating with five days overcast. This is not usual in midsummer, but we chiefly required strong winds to blow away the sea ice, so that Pennell could reach us. With a sailor's superstition Gran hung up his most dilapidated headgear "for a favouring wind." He said it always took effect in twenty-four hours. However, as was often the case with our sanguine prophet, nothing came of his forecast, and his stock was flat again.

On the 11th Debenham swore that he saw the *Terra Nova*. Gran confirmed this, and said the sails were set. I got hold of the binoculars, and alas! I saw *three Terra Novas*. They were miraged bergs, I fear. I thought it would be a good plan to have a signal on top of Discovery Bluff, and so Gran and I carried paper, blubber, and dried moss, to the summit, and left them there in readiness for a flare, if the ship approached. I carried up the theodolite, but did not take many angles, for it began to snow. When I returned, I found that Forde had kindly done my cooking—or rather greatly improved on it. He made some excellent chupatties from "thickers" and raisins, of which we had a small surplus.

That evening we had a great argument about the possibility of a German invasion, Gran *versus* Debenham, in

which Forde and I took sides to keep things lively. "We agreed that Germany could not conquer a colony, even if it *were* handed over to them ; that the Kaiser's aspirations ought to be humbled, and that the British officers were not so highly educated as the German." Gran had many tales of the vast amount of linguistic and mathematical knowledge which they amassed.

Friday the 12th.—No sign of the ship ! This is the day I backed for our meeting. However, my cookery is over for a time.

Gran and I walked over to the Tongue to measure the movement of the ice. On the 26th of December I had sighted on to the stake with the theodolite, and obtained a movement of thirty feet in twelve days. "She is fairly galloping to sea." On this occasion we both wore spiked boots, and so had little difficulty on the glacier, though the recent snow had hidden all but the largest crevasses. On arrival at the stake —which had not suffered from the blizzards—Gran lay on the snow with the field glasses, and observed Debenham, who was posted with the theodolite at the camp station. Meanwhile I moved east or west, and Debenham signalled to Gran until I stood on the transit with the crack in the Kar Cliffs. Now I made a direct measurement from this line to the stake, and found a movement to the east of eighty-two feet. Therefore the glacier has a velocity of almost a yard a day. The sketch (Fig., p. 374) shows exactly how this determination—which I believe to be the most accurate in Victoria Land—was made.

Gran suggested trying another route back, so we moved into one of the huge gullies (which nearly dissect the Tongue every half-mile) and we found it remarkably easy. There were three little lakelets between thirty-feet walls, showing there was no drainage into crevasses here, and we reached the bay ice with great ease.

I discussed pushing off for Cape Roberts instead of waiting close to the Bluff. There was no possibility of the ship coming in to us, and we could meet them as easily from the entrance. On the other hand, there seemed no way out of the *cul-de-sac* at Cape Geology if the ship did not arrive, and the sea-ice broke away. So, after talking it over, I decided to leave our headquarters on the 14th.

On the 13th Debenham and Gran went to the Bluff, and

Gran climbed to the top to scan the ice in Ross Sea. Debenham visited the flag, and made a chart of the great shear-cracks in the bay ice, due to the Mackay Ice Tongue.

Forde and I packed everything which we should need for sledging at Evans Coves on the good sledge. We packed the specimens, and some articles not now necessary on the "roof-tree" sledge. This necessitated dismantling Granite Hut, and very woe-begone it looked, with the sealskins flapping dismally on its walls. They had turned into fine *black* fur now, but were not beautiful enough to warrant transport on our heavily laden sledge. The skuas enjoyed our removal. They pounced eagerly on our specimen bags, and flew off some distance with several, in the hopes of finding a dainty morsel.

I was much amazed at the unusual sight of two skua gulls amicably tearing a piece of blubber up between them, and bolting half each. I never saw another instance of so much sociability.

"On Sunday, January 14, I woke the others at 6 a.m., having had to keep awake an hour or so to do it. We had food quickly, packed up, and were ready to start about twenty to eight. I should think our sledge had 900 lbs. on it, which is about a record down here. We got over our 'Pressure Pier' to the bay ice without much difficulty, though it is very narrow now. Later parties will have to find a new route.

"We found the sledge pretty hard to pull, and it took us over an hour to do the first mile. When you are going slowly it is always twice as hard, and lasts twice as long! This looked bad with nine miles to do. We got over the first tide crack, near the signal flag, by means of an island. Then we halted for a rest, and marched along the front of the Bluff towards the Piedmont Ice Tongue. The east was very gloomy now, and it started to snow. When you are pulling half a ton, and know that the ice you are on was breaking up in January, 1903, this is not cheerful. However, I turned in nearer the land, so as to reach Avalanche Bay, where it was possible to ascend the cliffs. The snow got no worse, and the surface improved slightly. We could see two seals far ahead on the next big crack, and we found thirty feet of wet, mushy snow at the first spot."

A little searching showed us a possible track. Debenham and I, tied together, crossed first, and then the others, and

then we judged the sledge might do it. I expect it would have sunk like a stone if the ice had given way ; but we had to get over here, or nowhere.

The snow came down thickly now, and we plugged ahead by compass for the small Piedmont Tongue, where we had been held up two days on our arrival. Suddenly we seemed to run into a snow slope, and by a mighty expenditure of energy we got the sledge up on to the tongue, and were safely on fixed ice for the time.

We soon got the tent pitched, for there was not much wind, and had some tea. I will quote my diary.

"We were all in a cold sweat, for the work is very hard, and yet you don't keep warm. However, we got into our bags, and were soon warm, if damp. The blizzard was but temporary, and about 4 p.m. it blew over to the west. I crossed the Tongue to see the descent on the other side. It was about five feet down a steep snow slope. Beyond was a narrow shear crack with two seals ; but the big crack at the end of the tongue went further east. We pulled over the glacier and down the slope past the seals without difficulty. Then on a little further, and saw a crack to our right.

"It seemed only about a foot wide, and I was testing this weak spot with the ski stick, when the foot of soft snow on which I was standing collapsed, and I went into the water. Luckily I grabbed Deb's hand, and Forde and Gran got my harness. I was jerked out like a cork from a bottle, and was never so near flying. None saw the others pull, and they thought I felt very light. We plugged on to the east, and came to the main wavy crack, an ugly thing, thirty feet across, of mushy water. Luckily this also narrowed at the bend, and after some searching we pulled over him also."

I was getting thoroughly tired here. However, we could see our destination at last, and so pushed on. A keen wind came up from the south-west, and swept over the one hundred feet glacier wall to the south, driving snow across our course. We crossed a little crack which Debenham thought was new since the snowfall. To our left were many birds, about a mile away, and black patches of ominous appearance were showing. Debenham climbed on the sledge, and was sure it was open water, and I agreed ; but we couldn't do anything, and pushed on. "I got some relief for my tired legs by

marching a longer stride, and we plugged on, hoping it would hold firm another hour. However, at long length we began to see details in the never-ending glacier wall on our left—icicles, crevasses, and snowdrifts,—and at last could make out a feasible slope up on to the Cape, and felt safe. I had cramp from the pulling, and couldn't move for a time." Then it was a distinct anticlimax, when we got to the top of the Cape, to see that we had been misled by some queer shadows, that there was firm ice for at least seven miles, and no sign of water anywhere! However, our experience at New Harbour made both Debenham and myself realize the risk we were running if the break-up of the ice, now long overdue, had eventuated.

"Monday, the 15th January, 1912; the day on which we were to be relieved. 'Nary a relief, nor any sign of it, and skuas squawking round us!

"We surveyed our cape expecting to find pools of water in plenty, but there is none anywhere. Everything is covered with snow except the big boulders and two or three patches of gravel, of which we have annexed the largest. When we arrived each gravel patch was inhabited by a pair of skua gulls, which we may call White, Black, and Gray respectively."

We dispossessed the Blacks, and I put young "Blackie" in a new nest—just as well made as his own—a little distance away. Meanwhile Debenham set up the blubber stove on a rock ledge near by, to get to which he crossed the Grays' nest rather frequently.

The chronicle of these three families have been done into rhyme by the "Sledge Poet," and will be found to be pathetic in the extreme.

A TRUE ANTARCTIC TRAGEDY

On the Cape by Granite Harbour, where the Glacier shrinks away,
Happy dwelt three pairs of Skuas, fighting gaily night and day.
Skua-*White* possessed but one egg. Young Skua-*Black* to walk begins;
Skua-*Gray* was just expecting the arrival of some Twins!

To that Cape by Granite Harbour stagger in at bright midnight,
Blizzard-blown and Ice-tormented, Four exhausted men of might.
Boulders carpeted their refuge, each within a snow-field set,
Only three inviting tent-sites crowned the Cape . . . and they were LET.

Operates the law primeval, "Shove the weaker to the floe."
Fix the tent there in the middle, Skua Black has got to go.
With a shriek of rage and anguish fled the parents of S. B.
Little cared the callous leader; "Hurry up, and boil the tea."

By the nest of Skuas grayish, quick was placed the Blubber Stove,
And the incense thence proceeding made the skuas murmur "Jove!"
They *had* to seek another refuge. Bitter feelings filled their cup.
It tore their hearts to leave their offspring, so they sighed—and ate them up.

Very loudly yelled young Blackie, crawling round the tent all night,
So that kind and humane leader took him off to Skua White.

"Lo! a miracle hath happened," said returning Skua White;
"Here's our nest just *full* of chicken, full of howling appetite."
Said Skua White, "It would be best, for fear this should become a habit,
To feed *ourselves* upon our *egg*. (Besides, you may be sure *he'd* grab it.)

So little Blackie reigned supreme
Until one day when he was fed
(By that kind and humane leader
Foster-father, foster-feeder)
On rich and tasty lumps of blubber,
His little tummy stretched like rubber,
Stretched too much ————
and now *HE's* dead!

The skuas are the most quarrelsome birds I know. They would fight for hours over the carcase of a freshly-killed seal until they realized there was enough food for ten times as many skuas—and by this time the flesh would be frozen so hard they could make no impression on it. The penguins have their own peculiar propensities, while the seals used to amaze us by their callousness. The day after we reached Cape Roberts we killed a large seal and cut it up, while another twenty yards away watched us quite casually, and did not budge for hours.

There was nothing much to do on the Cape. It was triangular in shape, rising about fifty feet above the sea ice. The broad base of the triangle was covered with snow, which gradually merged into the Piedmont Glacier. There was no ice-wall here, so that the glacier was presumably stagnant at this corner. The great granite tors of the Cape were all flattened, showing that they had been planed off by a former

extension of the ice-sheet. Debenham spent some time making a detailed plane-table survey. I fixed several theodolite stations, but as the days went by our life settled into a monotonous round.

I cut the meals down to two a day. We had plenty of seal meat and biscuit, but all the other stores were approaching their last week.

We used to have a meal about 7 p.m. every other day, a half ration of pemmican; for although seal meat is not so black as it's painted (and it's very black indeed), yet we had eaten little else for a month, and were all heartily sick of it. Then we turned in, and used to yarn or read till about 3 a.m., when we managed to get to sleep. We turned out at noon, and had a biscuit and seal lunch. During the afternoon we used to walk over the cape and inspect the cracks in the sea ice. One man was kept fairly busy cutting up seal meat, and the cook coaxed the stove to cook the fry.

Debenham was our only smoker, and certainly found tobacco a great solace. I had brought socks instead of tobacco, and had looked forward to jeering at him when his tobacco and socks gave out. Unfortunately our socks lasted much better this trip, as our boots were stronger, and I never used my spare socks!

Gran started a drama—a great nature play full of storms and wrecks, with a strong substratum of melodrama. It was called "Tangholman Lighthouse," and we used to urge him to fill it full of incident, and cut out the "nature" part of it. I read "Martin Chuzzlewit" for the ninth time and found it, as always, very interesting; while Forde tackled "Incomparable Bellairs"—a book which charmed Gran—but luckily Forde made it last a very long time.

We played chess with our cardboard pieces. I think we were fairly even, though Debenham tried risky openings to my advantage. The place of Evans as Society Entertainer was taken by Gran. His varied adventures in Arctic seas, among the Andes, in Turkey, Venezuela, and others of the less-known regions of the earth interested us much. He was, I remember, very anxious to experience the delights of station life as pourtrayed by Debenham.

The 20th of January was Gran's birthday. I was sorry I couldn't return his kindly present (of Savoy sauce, etc.),

but I told him I would give him a ship during the day. The Sledge Poet contributed the following Birthday Ode, dealing with Gran's Nietzschian principles; which is here published with Gran's gracious permission.

ODE TO TRYGGVE

ON HIS 23RD BIRTHDAY, CAPE ROBERTS.

(Chanted at ye Full Pemmican Feast.)

O Trygge Gran, O Trygge Gran,
I would thou wert a moral man,
And yet since we
(The other three)
Are just as moral as can be,
A "soupçon de diablerie"
Improves our little company.

O Tryggve Gran, a holy calm
Is most essential in a psalm.
But prose should be a thought less calmer
When elevated into drama.
And yet though we
(The other three)
Are critical to a degree,
We wish success some future day
To the first Polar "Nature Play."

O Tryggve Gran, thou art a man
Who hath compressed within a span
Of three and twenty years, such deeds
That hearing which, each man's heart bleeds
Among us three.
And yet though *we*
Are kind to every girl we see,
I have no doubt each lovely creature
Would rather help *you* follow Nietzsche!

Oh, Tryggve Gran, you should be dead
A-many years ago—instead
Of which, he saves you oft,
That "Little Cherub up Aloft."
And therefore we
(The other three)
In this new principle agree,
(As with your luck no man can quarrel)
'Twill serve us best to be *un-moral!!!*

I was just writing the last line of the poem when Gran yelled out "Ship ho!" We had seen ships many times already, but he was certain of this, so we turned out, and there, under the fang of Erebus, we could see some topmasts. Later we could make out three masts and black smoke, so we knew it was the good old *Terra Nova*, and not the *Fram*, which burned smokeless oil fuel.

We set about elevating our flags further up the glacier. We took them up a long way, nearly to the top, as we thought. On our return we saw they were only one quarter of the way up, a good example of the trickiness of snow-slopes in this respect. I arranged night watches to observe any signals or sledge parties, and we turned in hoping to be aboard in twenty-four hours.

[Nay, gentle reader, you are not at the end of my narrative; it was just twenty-four days before we were relieved.]

Next day she was in much the same position, about twenty miles away across the screw-pack and broken floes. About two miles away a great crack stretched from north and south. It was fully eight miles long, and seemed to presage the breaking up of the sea ice.

On the 22nd we could not see the ship. A strong south wind sprang up, and the gradually clouding sky seemed to portend a blizzard. "The stronger the better," I write, "if it will only drive out this blessed floe." We took a few photographs. There were two Emperor penguins moulting on each side of our Cape, but Debenham reported that they were too frightful to photo! Forde and I had a day with my stereo-camera, taking various interesting details around the Cape—planed granite blocks, pressure ice in the bay, and then the Emperors, awful as they were, several seal and berg pictures, etc.; but sad to relate all these negatives were smashed when the sledge fell over the glacier cliff. However, I made sketches of the most interesting features; for instance, one corner of a berg showed very well how flexible are large masses of ice.

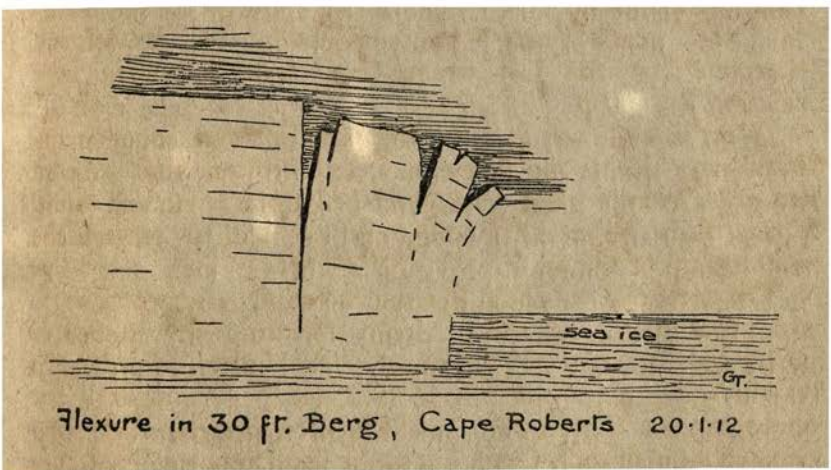
I did not entertain the idea of trying to reach Pennell across the screw-pack. We should get into more precarious regions each mile, and we could not communicate with the ship to ensure her awaiting us. Pennell could send a party

with safety at either end if he desired. I was, however, very glad later to find that Pennell also considered the pack absolutely impossible for sledging from the ship.

We saw her during the next few days, and then she never showed up again.

On the 27th a blizzard started, which we hoped would move out the ice. It tore our sledge flags badly, so that we brought them down from our distress signal 350 feet up the glacier, leaving the big depôt flag there.

It was very trying work with the blubber stove, for there was no shelter on the Cape. When there was any wind the flames would blow out of the door and gave no heat at all. The water did not get tepid in half an hour, whereas on a



calm day it would boil in twenty minutes. I spent an hour trying to cook the fry, and barely succeeded in melting the fat. We decided that the stove could not be used in high winds, even though it was in a sort of ice cave and the cook sat in the door to keep the wind out!

Our rations had been cut down by half for a fortnight. We now had three or four biscuits a day; butter, every other day; chocolate, one stick; pemmican, one-eighth; sugar and tea, two-thirds a day. However, we had plenty of seal meat, and as we were not working we required much less food.

So passed several days. The tide-crack was groaning all round the Cape, large pieces of floes floating loose in it, and jostling each other as the swell came in from the open water

twenty miles away. Gran spent all one afternoon making chupatties. The lid of the camera box was his pudding-board. He used the wheat-meal thickers for dough, and commandeered our allowance of raisins. The cakes were cut out with the rim of a cup, and then fried in a mixture of butter, fat, blubber, and soot. Anyhow, the result was highly successful, though the inside was somewhat wet, and the whole, I should now consider, distinctly heavy.

Each day we started the last bag of something precious. First the pemmican, then the chocolate, then the butter. Only one seal had been visible for some days, and I decreed his doom. He lay on a large piece of ice which was rising and falling with the swell. We reached this across an ice island, surging about in a large pool. In spite of all this movement no more of the ice moved north, as far as we could judge.

On the evening of the 1st of February I held a council. Captain Scott's instructions read, "I am of the opinion that the retreat should not be commenced until the bays have re-frozen, probably towards the end of March. An attempt to retreat overland might involve you in difficulties, whereas you could build a stone hut, provision it with seal meat, and remain in safety in any convenient station on the coast."

However, he gave me permission to begin the retreat if we were not relieved in January, and I began to prepare for this event.

Cracks seemed to be spreading in the sea-ice even while one was watching it. The surging ice in the tide-crack, now twenty feet wide, rose several feet. Now and again a huge shock-groan, like a big rock bumping on another, announced a new crack, while a constant roar, like that of a distant lion, announced the periods of maximum of the swell rolling in from twenty miles away.

On the 3rd of February Debenham, Gran, and I climbed the glacier slope behind our camp to prospect for a path. We roped up and proceeded about three miles southward, keeping well behind the crevasses. These are numerous on the steep seaward slope, but we met with none on the fairly level ground, though we could see them just below us. The surface was fair, usually two inches deep in snow and occasionally a foot deep. This did not promise easy sledging;

but the snow was dry now, and I was going to cut down the weights to a minimum.

We could see open water about twenty miles off, but a huge mass of ice-pack was apparent as far north as we could see. There seemed to be a broad belt at least sixty miles long, which was quite absent in January, 1902.

Obviously our exploration of Terra Nova Bay was impossible now, and it looked as if the ship would never reach us at Cape Roberts. With good luck we might cross the Piedmont Glacier to Cape Bernacchi in a few days, and Pennell might find it easier to reach us there, while we should at any rate be nearer to Headquarters. There was also a week's food there, and we had now only a fortnight's sledging stores left.

On February 4th Gran and I explored the sea ice below the Piedmont for about four miles to the southward. We passed through the fifteen bergs in the little bay and then got among the screw-pack. This was covered with snow and afforded extremely heavy going, as may be imagined. Near the shore was a perfect network of new cracks with the ice "working" all the time. Below the glacier wall was a deep tide-crack four feet wide, but where the ice had fallen in we managed to get across to fixed ice. As a result of this journey I decided to march first along the sea ice and then climb up the Piedmont at this point.

Next morning I wrote a long letter to Pennell, which we all signed. We made a depôt on the highest point of the Cape and fixed a flag alongside, with the letter in a little matchbox. The journal for Captain Scott I left in my ditty bag. I remorselessly weeded out every one's gear. We took nothing but what we stood up in, and our notes and the instruments. Luckily, most of Debenham's and all Gran's negatives were films, but I had to leave nearly all my plates and my cherished Browning. I knew we had some bad crevassed country to traverse—thirty miles of this, and then I expected thirty miles of coast work largely over moraine and rock, where we should have to portage the sledge and all our gear on our backs. With a light sledge it was just possible we might be able to raise it if it slipped down a crevasse; and this was quite a probable event, for in traversing along a piedmont glacier the party moves *parallel* to the crevasses. It thus reaches them imperceptibly, and the whole outfit may be over

a crevasse together, whereas in crossing them at right angles this is rarely the case.

We turned our backs finally on Cape Roberts at 11 a.m. on the 5th. Our flag waved bravely, and below was the cairn of stones covering the food left there by Scott's orders. If we had to return it would give us a breathing space, but I never saw the Cape again. For many months the flag was left in solitude. The screw-pack never broke adrift that winter. In the next spring, six desperate men sledging southward, as they thought, to more endurable though no less solitary quarters, here found the first news of the main party. Our depôt possibly saved Browning's life. It certainly gave the Northern party their first bearable day for many months. Brave old flag! it hangs in Tewkesbury in Priestley's home, and there my old Browning was restored to me after many months!

So we marched on; we were all stiff and out of training, and the sledge did not pull easily, but we reached the tide-crack and crossed it much more easily than I expected. After lunch we pulled up the steep slope of the glacier, and to our delight found the surface grow harder almost every hour. But other troubles were upon us. For three days I felt it would not benefit any one to write my diary. However, on the evening of the 8th I wrote up the 5th, 6th, 7th, and 8th of February as follows:—

"Then quite suddenly we came on huge crevasses all round; some open, which I took care not to keep too close to, and others bridged. They seemed too wide to do anything with; but after cautioning the others to tread quietly, I prodded across safely, though the ice-axe pushed in all its length easily. Then the others followed, and the sledge after. Gran fell in at the near edge and saw the straight wall. Several of these were over twenty feet wide, but we had to chance them, and tested them all before the sledge started. Then we marched along between two fairly visible ones, and luckily they didn't join. The surface got flatter and they died out gradually so that we made fair progress. We came to another enclosed snow basin, and I felt sure the seaward slope would be safer. So it was, though Forde went down a small crevasse. We pulled along this up to a sort of col—about eight miles from Cape Roberts,—and here, as we were well beyond the mouth of the Big Valley, we camped.

"My only fear now was that bad weather might cover the glacier with soft snow, for I felt that all the big crevasses would be lidded, and the little ones could hardly swallow the lot of us."

Next morning we made the harness traces longer, so that only one man at a time need cross even a wide crevasse. We had to traverse the mouth of another large valley glacier. Three of these debouched on the Piedmont Glacier from the western mountains, and the pressure from the northernmost (the Debenham Glacier) was responsible for the crevasses of the 5th of March. The second valley glacier was not so large, but we anticipated trouble. We had a stiff pull uphill for three-quarters of a mile, but some of the snow was so hard that the sledge-runners made no mark. This was an ideal surface, for one's feet did not slip on it, though occasionally the sledge skidded. We were about seven hundred feet above the sea here, and entered a col just below a huge snow hill.

"Afterwards we were cutting around the hill aforesaid, when suddenly appeared many crevasses. So we deviated abruptly and ascended sharply. We encountered three, into one of which I fell, but they were not very wide. The moral of this is—Don't go for the break of a hill facing and near the sea, but stick to humdrum grades if possible; if not, still don't go for the break of a hill!"

The somewhat frivolous tone of the above note is evidence that it was written when we had traversed the worst of the Piedmont. It was always the case "down South." One never got photographs or "instantaneous pen-pictures" of anything really exciting. It was always a case of "Get a move on, and get out of this good and quick," so that one's diary lost most where it would have been most interesting.

We were now behind Dunlop Island, and about 1250 feet up the Piedmont. We were astonished to find that the floe had all broken up to south'ard. Long curved cracks parallel to the coast marked where pieces were continually floating off. We congratulated ourselves on our safe position on the Piedmont, for we should have sledged into this without knowing it had we continued much further on the sea-ice. Small bergs looking just like white yachts dotted the open water, which seemed to extend south to Castle Rock. There was no sign of the *Terra Nova*. We began to think she had come to

grief, for Pennell knew we were free to move off on the 1st of February.

After supper Debenham got out his plane-table and continued his survey. He was much puzzled by the position of his station on the stranded Glacier Tongue to the south-east. He realized soon, however, that it had twisted round, and was even now preparing to continue its journey to the Nirvana of warm northern waters.

We had been blessed with sunshine the last few days. I don't believe we should have managed to dodge the crevasses otherwise, for in dull weather you cannot tell any difference between a ten-foot hollow or a ten-foot hummock when it is only a yard or two away. However, as a result, Forde got a bad touch of snow-blindness. Debenham got out the medical chest. He ground up some $ZnSO_4$, picked it up on a paint-brush, and dropped it in the corner of Forde's eye. Later in the night I gave Forde another dose, for the pain is pretty considerable.

The next day my right eye was sore and watering, in spite of the amber glasses, and I feared I was to become a patient also. We plugged along over an absolutely level snow-plain, when Debenham dropped into a crevasse, over which I had crossed without puncturing the lid.

In the afternoon my eyes gave out, and I put on bandages on the right eye, and gave up the lead to Debenham. It was an astonishing relief to cease from staring at the glaring surface, and either pull along with shut eyes or keep one eye on the gratefully dirty back of Debenham's jacket.

Debenham led us safely past three huge crevasses, and we halted for a spell among a cluster of smaller ones. That evening we climbed up the snow hill behind Gneiss Point, about 1350 feet above the sea; and as we had now passed the third valley glacier, I felt we had finished with the crevasses for the time being. We camped on hard snow, and Debenham treated me for snow-blindness. The zinc sulphate may truthfully be described as an eye-opener, but later the cocaine in the mixture calms things down. You are advised "to keep your face cool." But I had to keep my head in the bag to get warm. However, Forde was pretty right next day, and mine had stopped aching, though everything appeared double for many hours!

On the 8th we reached the land near Cape Bernacchi. There was a steep ice-slope two hundred feet high, at an angle of 30°. Luckily it was much honeycombed and sun-eaten. We put grummets (rope brakes) on the sledge, and managed to get it down about 130 feet. We had a very cheerful lunch, for we knew the depôt was only a few miles south. Then we found an ice-foot all the way along the edge of the rocks and moraine which led us right to the Bernacchi cairn. This was a regular ice pathway about twenty yards wide. It was due to sea-ice which had become cemented to the shore, the tide crack being further away from the rocks, and defining that part of the floe which had lately drifted away to sea.

No one had visited our depôt. New Harbour was full of new broken floe, but a fine ice-foot seemed to promise well for our next march.

We stayed a day at Cape Bernacchi, for I wished to get a good station for the triangulation of this coast. Gran and I took the theodolite to the top of a hill 2900 feet high, at the north-east end of Dry Valley. We named this Hjort's Hill, in honour of the maker of our trusty Primus lamp. As we were climbing this hill, Gran swore he could see the ship off Cape Evans through the binoculars. It seemed clear to me also—smoke, crosstrees, hull, and three masts; but after an hour or so we decided it was only a mirage crack in the Barne Glacier. The disappointment was rather keen, though I am now not so sure that we did not really see the ship, some forty miles away. We could see the forty-foot debris cones behind the hut quite easily on a clear day.

I wrote the usual letter to Pennell. I had left two in Granite Harbour and two on the Piedmont now, and it did not look as if any would ever be read.

All through the 10th we skirted New Harbour, finding a fairly feasible ice-foot between the granite-strewn slopes and the open water. We came across a Spratt's biscuit box here, which was evidently left by the 1902 expedition. We saved a considerable detour by crossing the head of the harbour on the sea-ice, and camped below the Kukri Hills, where I halted rather early to get a round of angles. We were held up here all next day by the snow, which we spent reading and sewing.

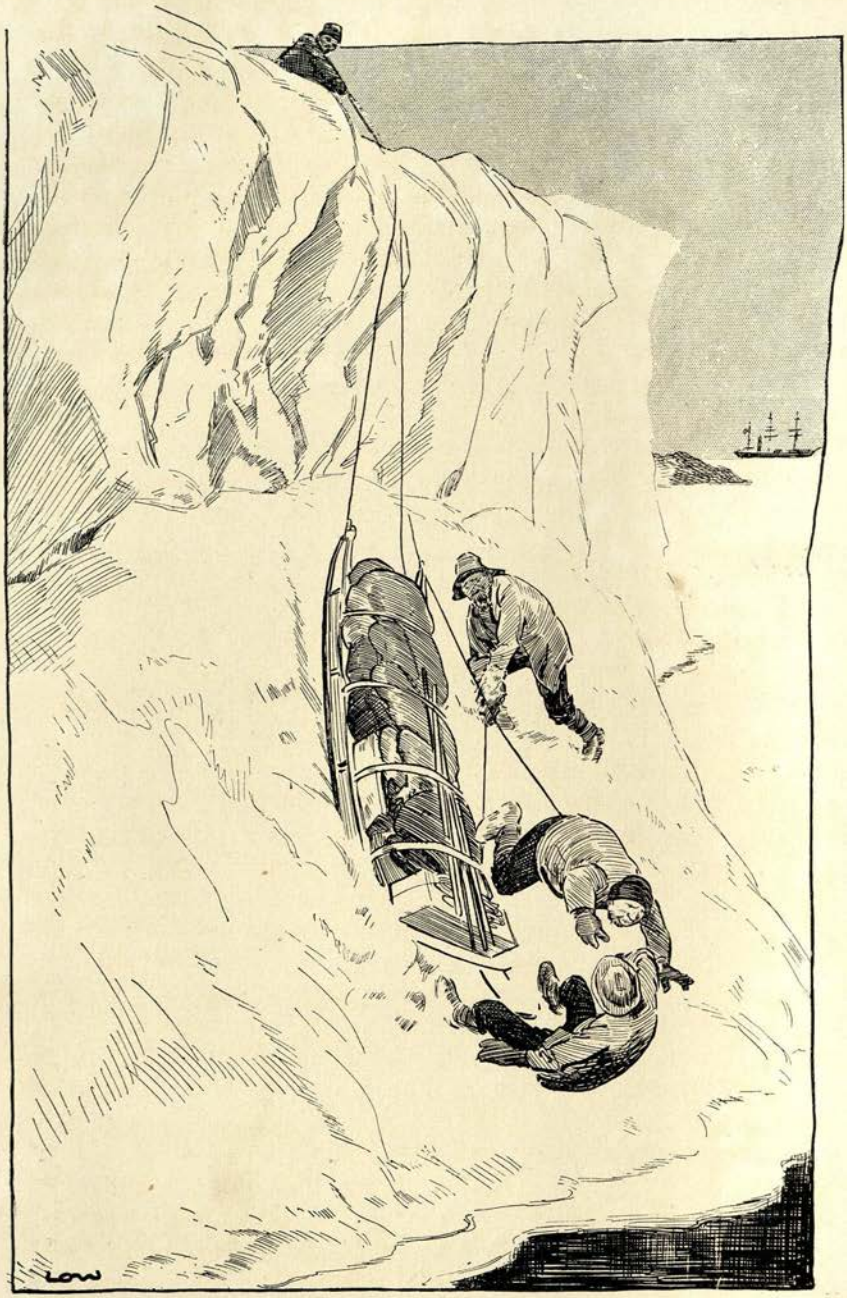
On the 12th we rounded the Kukri Hills, and when the

ice-foot petered out we were luckily able to continue on the sea-ice. We had lunch amid a colony of over forty seals, and then reached the southern side of the Ferrar Glacier, where we camped on a rather wet and muddy heap of "road-metal" moraine.

We were now safely round New Harbour, and, curiously enough, crossed the sea-ice at the mouth of the Ferrar on the same day of the year as when we nearly went out to sea on our first sledge journey. Henceforward we knew our route. We had plenty of food at the Butter Point depôt, which we reached that evening, and knew we could reach the old *Discovery* hut before the end of the month.

The depôt had been blown over and wrecked generally. We took some pemmican, butter, and chocolate, and next day proceeded south along the Butter Point Piedmont. The surface was much better than the preceding year, but, curiously enough, we found quite a number of small crevasses. Debenham and Forde fell in together in one of these, and the burly Irishman jammed so tightly it was quite a business pulling him out of it. In the evening we reached the Strand Moraines. These are great piles of ancient silt, gravel, and erratic blocks, which were dropped here by the ancestor of the present Koettlitz Glacier.

At the southern end of these moraines, which were several miles long, was quite a large lake. We tobogganed down to this and across to a nice little gravelly delta just made for the tent. We found that the open water reached just to this point, the sound still being frozen to south'ard, though obviously breaking away in great sheets. I wrote that night, "No *Terra Nova*. We should be picked up at Evans Coves (Terra Nova Bay) to-morrow!" We had the choice of two routes now: either to cross the snout of the Blue Glacier, or to take to the sea-ice and coast round the latter. We had done the former and knew it would only take a day. The latter might be quicker, though a great calved berg blocked the route about two miles ahead. Debenham preferred the glacier, the other two the sea-ice. I considered it unsafe to march on the sea-ice if it could possibly be avoided. I made a bet with Gran that we couldn't get the sledge between the calved berg and the glacier without unloading it. This had a rather interesting outcome. I decided to



THE RUSH TO SAFETY: OVER THE EDGE OF THE BLUE GLACIER.

From a drawing by D. Low.

keep to land ice, on the principle of the "Devil you know being preferable to the Devil you don't."

It was annoying to find that the Blue Glacier had so completely changed its complexion in the twelve months. In place of clear blue ice where one could see every crevasse, it was one uniform sheet of smooth snow, and we soon began to fall into the crevasses. In a very short time we had all been in a couple of times, and it was evidently an unpropitious region for sledging. I deviated to the edge of the glacier to try and lower the sledge on to the sea-ice, for we were now abreast of the calved berg, where we halted a few minutes.

Away to the south-east we could see a blizzard brewing, and I wanted to get a snug camp in the gullies south of the Blue Glacier. We had an argument as to who had won the bet, for there was a jumble of ice where the calf jammed the parent glacier. The other two decided in my favour, and so we pushed off on the top of the glacier-edge to the wished-for camp. Gran was dissatisfied with the court's decision, and kept glancing back to the scene under discussion. Just as we were dipping down the slope he yelled out "Ship ho!" and there she was over the top of the black moraines.

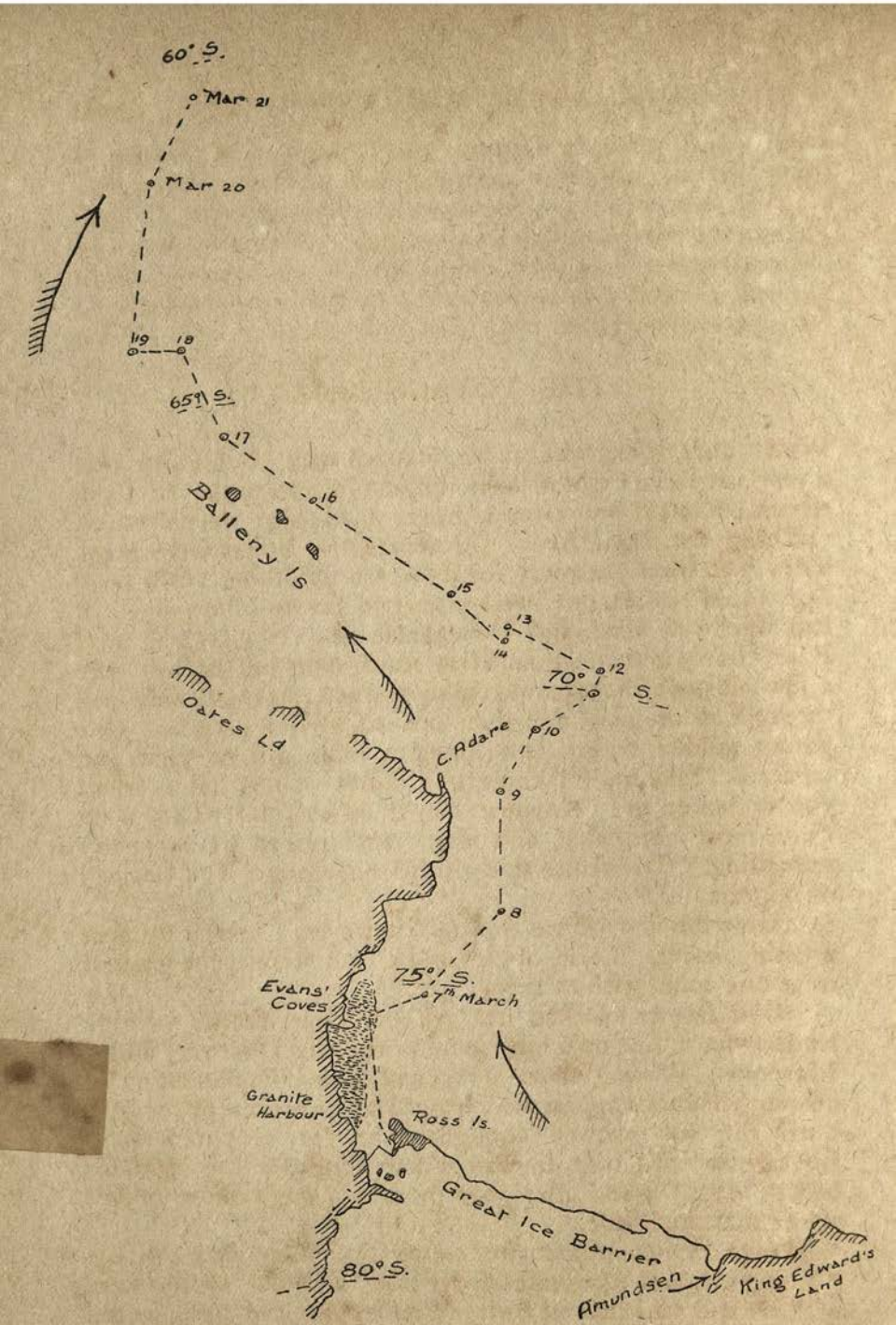
"We turned back at full speed to retraverse the crevasses, for she was four miles off and we were afraid might miss us, as a snowstorm was brewing in the east. She steamed along past the berg and out along the floe. We pulled back hard, crossing crevasses carelessly, but not falling in much, and finally could make out that she had a flag on the gaff, apparently recognizing us. We kept along the edge of the glacier till we could find a place to get down. Here was a drop of thirty feet almost vertical with a big tide crack and a tide-pool at the bottom! Gran went down first, and then I got down halfway. Unluckily as we were lowering the sledge Forde was pulled over by his harness and fell right on to Gran, who was pressed into the snow while the sledge came down on top of us. It nearly broke in the middle; however, we lugged it over to the ice and set off hot-foot over the two miles of ice. The ship now anchored near the floe and four men came to meet us. They harnessed up and told us the news. We heard that the Southern party were going very well, that there were no signs of Amundsen, and that there had been no accidents of importance. Also that

they had not been able to communicate with Cape Evans until a week before, and had been unloading stores every available moment before they came over to search for us. And then the world's news made us feel safer in the Antarctic at first hearing: the disruption of China, the Franco-German-English trouble in Morocco, the Italians and Turks in Tripoli, and the great strikes in England. We had missed an eventful year during our sojourn in the peaceful regions of the South.

VII

THE VOYAGE BACK

February–March, 1912



Return voyage of the *Terra Nova* in March, 1912, showing pack-ice off Evans Coves and Granite Harbour and the dominant winds determining the ship's course.

THE VOYAGE BACK

WHAT does it feel like to be in touch with civilization after a year's absence? Man is an ungrateful creature, and I can remember what we missed, better than what we gained on reaching the *Terra Nova*. However, the letters were there. They had been put ready for us in the wardroom. No small bag would suffice, our literary matter ran to pillow-slips. I had one well filled, and Debenham, lucky beggar, had two! Poor Gran's home mail failed to reach him, and he had only a few bills, which he could have spared. I rapidly skimmed through all the news and then opened up the packets. One young soldier friend sent along a huge gift of pipes and tobacco. Said he, "I know you didn't smoke, but I expect you've learnt to! Anyhow they'll be useful." They truly were most acceptable, and were most prized by the party remaining. To balance this gift he sent along "The Geology of Nigeria."

After the first glance through, however, I turned to more pressing needs. Clean clothes and a bath seemed the greatest treat one could wish to enjoy.

Two factors blocked us. All our clean clothes were on land, some in our own hut, some in the Old Discovery Hut! Moreover, Ponting came along and after complimenting us on our villainous appearance, begged us to remain picturesque until the sun showed enough light for a photograph! Luckily we had only to wait a few hours for this specimen of "ponting"; and after four months a day's more or less grime mattered little.

One disappointment we met with. Our first cry was "Letters," and our second "Fruit." Drake sympathized with us and said that all fruit except apples had been landed at the hut a week ago. However a box of apples had been

reserved for the Western Party. We rushed that box. The apples were icy cold and frozen solid. Eagerly we placed some on the top of the wardroom stove. We waited until they were well warmed and then voraciously bit into them, to encounter a stony iceberg in the middle! They took an incredible time to thaw, and then all the plant cells had burst, and the apple was a poor thing all brown and almost rotten!

In my cabin I found a small tin trunk with better fare: cakes, sweets and nuts of all descriptions, everything but chocolate. After hearing the yarns of some of Shackleton's men, I expected to be surfeited with chocolate, and so warned my people not to send any down by the ship. However, the other luxuries were well-chosen and abundant. Every officer aboard had selections each day, and not till we reached the Circle nearly a month later was that tin box depleted. Indeed, one cake from Parramatta friends was so large that a half was sent to gratify the mess deck!

When I was free from Ponting I bolted into the engine room and was provided with a huge bucket of scalding water. Rennick and other officers had lent me some clothes, and I can still remember that bath. The only available space was over the boilers! I was jammed into a narrow passage next the ship's timbers. If one bare foot slipped an inch too far it touched the boiler plates; if the ship gave a lurch I cannoned against huge baulks of oak. Still, I started as a toil-worn and wild-eyed refugee and finished a semi-respectable roustabout!

Pennell soon gave up all hope of reaching Cape Evans. The blizzard which was brewing at noon, on the 14th, soon enveloped us, and we were driven far north. Under these circumstances he deemed it advisable to make the best of it, and proceed to Evans Coves to try and rescue Campbell's party.

Among my mail I found a book sent by Professor David. This was "Queed," by Harrison, a writer new to me. This novel fairly gripped me, and I turned into my bunk all standing, and read until I had finished it. I hope all Mr. Harrison's readers derived as much pleasure from it.

"Jim" Dennistoun was a welcome addition to our mess. He had been eager to see Antarctica in any capacity, and so

came along as mule-overseer. His remuneration was "all found, and one shilling a month." We often used to discuss what he would do with the treasure accruing to him when he was paid off! An ashtray, beaten out of the four-shilling piece, was the memento he favoured.

But it was fairly uncomfortable on board. It was now very cold, and the sun rarely showed for long. Spray was driven over us, and froze where it fell, so that we spent hours chipping the decks free from some of the icy layer. The wardroom seemed all doors, and draughts assailed us everywhere. As usual, on approaching civilization, the Antarctickers contracted influenza. Debenham was really quite ill, and I had a fearful attack of neuralgia, which lasted a fortnight, due to a gaping tooth. We used to think of our snug little tent on terra firma, and after a week of storm at sea decided that we were sorry we had been picked up by the trusty whaler. Such is man's ingratitude.

"*February 23rd.*—We spent a most forlorn day. The ship absolutely jammed in *new* ice, formed of pancakes only three or four inches thick, but gummy, not brittle (so that the ship couldn't break through). These were formed of still smaller cakes, cemented together. I was sure they had grown *in situ*, perhaps in the lee of a huge piece of pack which had drifted off.

This was very serious, for every hour increased the risk of our being frozen in, and this was obviously still more probable when we returned to Cape Evans than in our present position, so much further north. However, very suddenly the soggy ice was broken by long leads—lying rather far apart—and we managed to push and butt our way considerably to the east.

I was down below when I heard the ominous "three whistles," which signifies "all hands on deck." However, in this case it was a call to "rock ship." We all lined up at the port bulwarks, in the waist of the ship. Then Bruce gave the word, and we "set to partners" across the hatches, and through the narrow spaces to the starboard side. The ship swung very slightly in consequence. Bruce timed its swing, and then we all ran back in unison. This time the swing was a little larger. So by degrees the ship became a self-acting pendulum, and gradually rocked herself free from the close embrace of the ice. At the same time the propeller revolved about 1½ times the normal speed, and the ship began

to give a little, and finally went astern. Then more butting, and a jam or two, and finally we got into looser pancake, where she could do four knots.

Emperor penguins were interested spectators of our manœuvres, while the distant coast-line was really of great interest when we had time to observe it. Mount Melbourne was a finer sight than Erebus, for its cone was more symmetrical, recalling that of Etna. Mount Nansen, further south-west, was a huge, flattened scarp, resembling Mount Lister.

On the 24th we emerged again from the pack to be greeted with a pretty stiff wind. We steamed south to try and communicate with headquarters. Lillie told me of some of his results. He believed he could apply the teachings of Mendelism to the question of colour in half-caste Maoris. He had made some large collections of fossil plants in New Zealand, and had dredged up enough of the rare tunicate *Cephalodiscus* (a primitive sessile early vertebrate) to supply every museum in the world! I found out that my thousand insects were probably *Gomphocephalus*, of which previously only a few odd heads and legs had been collected in specimens of Antarctic moss.

We got back to the Sound off Cape Evans about noon on the 25th. A howling gale was blowing so much frost smoke into our teeth that we could only just see Inaccessible Isle, now covered with a pall of snow. We manœuvred in North Bay with the 120-foot wall of the Barne Glacier looming very close. There was a touch of east in the blizzard, so that the glacier was not quite on our lee. Pennell dropped anchor when the soundings showed twenty-five fathoms, but we drifted back quickly, and when we reached fifty fathoms (three hundred feet) the anchor dragged.

We had an awful job hauling up the anchor! Whenever I hear the phrase "Merrily round the capstan, boys," I think of that weary time in North Bay. Each capstan bar had two and sometimes three men pushing it round. The foc'sle deck was iced over, and even a layer of ashes afforded little grip, for the blizzard heeled the vessel over, till the deck sloped like a roof. "They tried to help the capstan by a chain to the steam winch, but the latter 'took charge' and nearly flung Bill Heald off the foc'sle! There was precious

ENGINEER WILLIAMS AT THE WINCH.

BERNARD DAY ON THE CAPSTAN.

little room between the capstan bars and the rails, and I got jammed, and received a nasty bruise on the leg. Awful stiff on one's hands, and on the calf muscles—like pushing for hours in a football scrum! Pawls (or stops) prevented the capstan from releasing the chain. Clink . . . clank, clink . . . clank; these pawls would sound every minute or so, and then we had to rest. Each clink meant only an inch or two of cable, and we had to haul in three hundred feet! When the ship twisted, and the cable lay along the side of the vessel, it was impossible to raise the anchor an inch. Finally the anchor caught a firm hold on the third attempt, about 7 p.m., and we lay steady with ninety fathoms out. The gale increased, and we all turned in to try and get some rest, and be ready to land if it lulled. At 11 p.m. Pennell roused us, and I got into the whaleboat. Bruce was in charge, and I rowed three. We were less than half a mile from the shore, and found the lee of the cape quite calm. So I reached the hut, after five months' absence. It was eleven days since we had been picked up, all but a few hours, and this was the first opportunity of communicating with our headquarters.

I stumbled up the shore, nearly waist-deep in snow, where in the preceding March there was hardly any! We found them all asleep, and by no means ready to come off. Simpson and Day were soon dressed. I had, luckily, left all my gear packed in November, and I hauled my boxes down to the ice-foot. Simpson, Day, Anton, and I returned, and after some bumping against the ice-ridged quarter of the *Terra Nova* we got safely aboard.

The gale began again, and all access to the shore was blocked. Simpson and I yarned till 5 a.m. He told me that Hooper and Day had reached the Hut on December 21st from the Barrier. They had found their four-man sledge too heavy, and having no suitable tool had burnt it in half with the Primus lamp! They had been caught in a blizzard, and had marched blindly north in the ensuing thick weather. Later, they saw their tracks led right between two parallel crevasses, either of which would have engulfed them!

"Next day we could not bring off Meares, Clissold, and Forde. Archer had gone ashore, so that the ship was now without a cook! The wind was fairly shrieking, and at 10 a.m. the anchor dragged.

"We spent a most wretched day trying to get it up. Not a budge out of it, though you burst a blood-vessel! The seamen couldn't say (as before) that this was due to work on a Sunday. We found that a cog had broken in the gears of the capstan; but when they again tried the steam winch to aid the capstan it stripped off more teeth!

Another method was tried in the afternoon, which was very slow, but not so spendthrift of human energy. It was called "luff upon luff," and depended purely on a series of pulleys; whereby a small amount of force at one end of the rope can slowly move a great weight at the other. The capstan was now practically useless. So the small steam winch was connected to a set of heavy pulleys (a "five-ply purchase," I believe, is the nautical term) to which a claw-hook

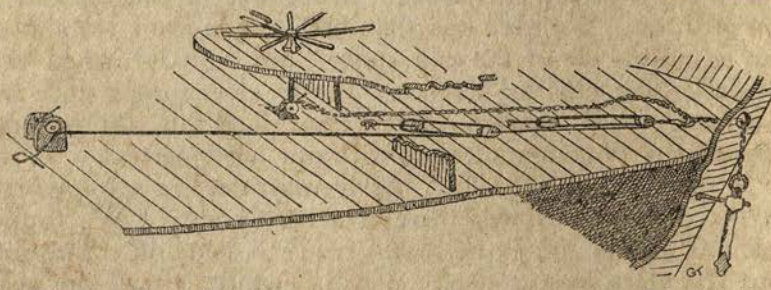


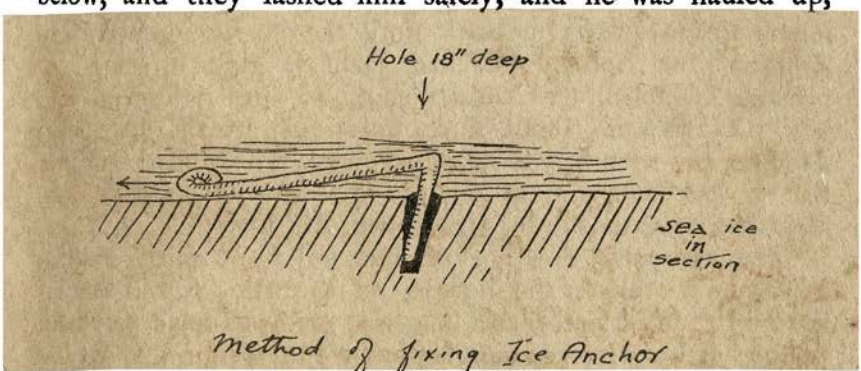
Diagram illustrating the way we managed to "raise anchor" by "luff upon luff," February 26, 1912.

was attached. This was hooked into the anchor-chain, at the hawse hole, inside the dark foc'sle. I was halfway man, and it was my duty to yell to the engineer at the winch, as Bruce advised me he was ready. Another yell meant that the purchase had done its part, and then Rennick put the capstan brake on (which would still hold, luckily), and the claw hook was taken off, and attached some links nearer the anchor. By 6 p.m. we had raised anchor. It came up as bright as silver, and with the crossbar (stock) broken clean off!

All this time we were drifting to the north-west, and had to keep up steam to hold her from yawing, and to try and keep the cable from "binding" on the side of the ship. Throughout the 27th we were nosing up against the fixed ice off Castle Rock, trying to shelter from the blizzard. By noon, on the 28th, the blizzard dropped enough for us to lie along-

side Glacier Tongue. At 3 p.m. the ice anchors held, and it was possible to get ashore, and start "icing ship," for the tanks were nearly empty. We had to lie bow on, and get the ice in by a basket slung from the foreyard. A very slow and laborious business; it took us six hours to get 4½ tons of ice aboard.

We then moved off to Hut Point, where we landed some stores and newspapers for the Pole Party if they should be isolated from Cape Evans, as we had been in April, 1911. Here I met Wright again. We learnt that Evans was very seriously ill with scurvy. They wrapped him up in his sleeping-bag and, dragging him to the ice edge, brought him aboard in the ship's boat. We let down ropes to the seamen below, and they lashed him safely, and he was hauled up,



Method of fixing Ice Anchor
28 - 2 - 12

looking more like a corpse than a live man. However, he could speak cheerfully enough, as usual!

We returned post haste to our hut to take advantage of the unusually calm weather. We unloaded more stores—chiefly fodder, coal, mutton, and dog biscuits, and then moved north immediately to make a second try for Campbell at Evans Coves (lat. 75° S.). Day, Dennistoun, and I spent the morning of the 1st of March shifting cargo. Indeed, we seemed to spend a large part of our time during the ensuing month in that abode of gloom—the empty hold of the *Terra Nova!*

At 10 p.m. we were about fifteen miles from Cape Washington, in very heavy pancake ice, with a slight swell. There was a thick ice-mush between the blocks, and this jammed the

propeller. For about ten minutes the engine could not move the shaft. They managed to prise the ice away finally by poking rods down the rudder post. The grinding and bumping of the blades on the ice was physically painful. It jarred one's whole system just like having a tooth out. The shock to the propeller, mainshaft, and engine must have been enormous. Luckily our propeller was four times the usual size for a ship of our tonnage; but Williams thinks the main shaft might go quite easily, and then we should be in a mess!

"*2nd March.*—During the morning we skirted the pack southward, doing a sort of 'blanket-stitch' course in a vain endeavour to find a passage through to Campbell."

Dr. Atkinson was on board attending to Evans, who was unable to move from his bunk until the day we reached New Zealand (2nd April). We had again to give up hope of rescuing Campbell, and turned south to land Atkinson. At 9.30 p.m. we were about thirty miles S.E. of the Drygalski Tongue, and soon had to heave-to on account of bad weather. But in the afternoon of the 3rd the wind dropped, and in about ten minutes the sea was frozen over!

However, this time we reached the Cape fairly readily, and when I woke on the morning of the 4th I found that we were off the Hut and that a boat was going to fetch Keohane. He and Atkinson were then landed at Hut Point, and we had to ice ship again at Glacier Tongue.

Every man was busily employed. Heald, McCarthy, Parsons, and Cheetham quarried the ice at the nearest spot where it seemed solid and free from snow. They filled baskets which Dennistoun, Leese, and myself pulled to the ice edge. Here Simpson and Rennick linked the baskets on to the rope, and Lillie, Drake, and Ponting hauled it aboard. Day and Mather carried it to the tanks, and Meares and Bruce tipped the baskets into the latter. It was hard work, and kept us going from 3 p.m. till 10 p.m. Still there was some fun at times. Leese harnessed the brown sledge dog Tsigan to help him with his sledge, and Tsigan occasionally bolted over the glacier. One basket fell into the sea, and Bill Heald lowered me on a rope till I could grab it; then (as usual) he hauled up too quickly, and I was dragged *through* the snow cornice and pretty well filled with soft snow!

"We shifted eleven tons, and now Pennell's notice * can be withdrawn. We now have enough to get back. Thank goodness!"

We had a fairly uncomfortable time on board. The stove below was faulty, and a change of wind filled the wardroom with smoke. With a huge skylight, various hatchways and companion ladders, and numerous portholes, it was hopeless to keep out of draughts.

Early on the 7th I was awakened by the fiendish clamour which the propeller was making about a foot under my bunk! "I found that we were held up in a hole about twice the size of the ship in heavy fixed pancake. We were over two hours alternately advancing, sticking, putting on more steam, reversing, and getting out. All the time huge blocks of ice were being churned round and battered by the propeller. We had been heading about N.E. when the ship struck, and in next watch we had to turn round and retreat as we had come. We were now about forty miles east of Mount Melbourne.

"She would steam steady for about ten minutes and delude one into going on deck to see our progress, and we were still in the same ice-hole! Then we would reverse with more regular vibrations, then catch a huge bit of ice in the blades, and it would feel as if you were having three teeth out yourself!"

At noon Pennell abandoned hope of getting near Campbell. At each attempt the ice was thicker and wider. Each time we got into worse positions and spent longer in extricating ourselves. "We are later than any former ship, not allowing for the extraordinary ice-bound conditions, this autumn." So we turned homeward on the 7th March, and headed for Cape Adare.

On this voyage the ship was in charge of Lieutenant Pennell, while Rennick and Bruce were the other officers, assisted by Cheetham and Engineer Williams. Lillie carried on his biological work, while Drake was busy as ever with secretarial duties, varied by readings of the meteorological instruments.

We had left the rest of the Western Party at Cape Evans,

* Until the ship is able to ice ship again no water is to be used for the purpose of washing clothes.—HARRY PENNELL, Lieutenant.

while Atkinson and Keohane were stationed at the Old Discovery Hut to receive the Pole Party.

The members of the headquarters staff who returned to take up other duties were Simpson, Taylor, Ponting, Meares, and Day. With the addition of Lieutenant Evans, who was at first seriously affected by scurvy, and Jim Dennistoun (of New Zealand), we formed a very happy family during the month of "wind-jamming" which now awaited us.

This was Jim Dennistoun's birthday, and to celebrate it and our start for home, I brought out the huge cake sent down from home. Half went forward to the mess deck, and it was much appreciated. We had a sing-song with banjo accompaniment by Ponting and Bruce, both of whom could sing pleasantly. Alf Cheetham gave us some typical sailor chanties in his humorous falsetto voice. Neuralgia kept me from adding to the entertainment, and I listened from the after cabin.

During the next few days the afterguard were glad to get warm either coal-trimming or hauling sails. We would be shivering in the wardroom when Pennell would come to the "balcony" and yell, "Any volunteers to trim coal?" Dennistoun was shipped as mule-overseer for the voyage down, and there was apparently a moral obligation that he should earn his shilling a week on the return by trimming coal! So he always turned out and climbed into the bunkers. We followed suit after a few days' rest, and worked away in the hold and in the warmer dusty "bunkers" next the boilers. Then another naval "tyrant" would look down at the coal-trimmers and yell, "All hands on deck to haul mainsail!" We were true sailormen in that a chorus of anathemas saluted our naval colleague! However, we'd go upon deck and get into oilskins and sou'westers, and then search out the special halyard in question, usually finding that the operation had been concluded some minutes previously!

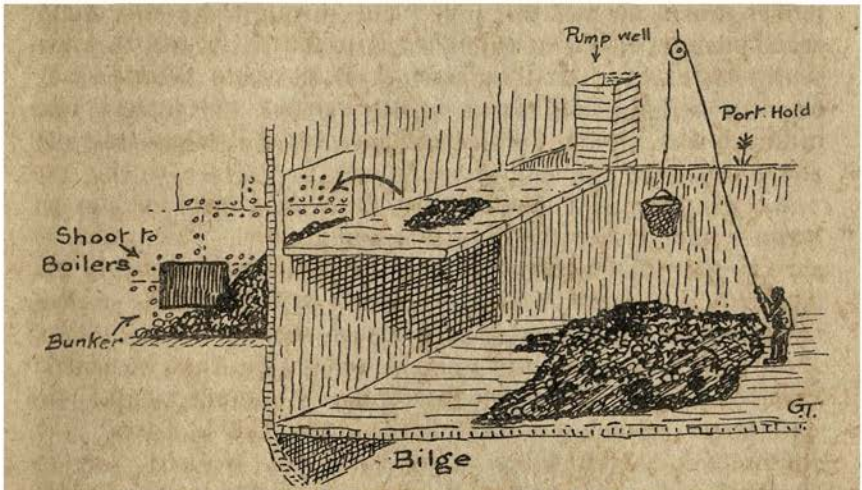
With two Liberal Socialists like Simpson and myself, it is not to be supposed that this continued long! We went on strike and delivered our ultimatum—

"Either coal-trimming or sail-hauling—but not both." Pennell grinned cheerfully, and said we could do all the coal-trimming if we liked. Personally I felt this was more scientific, as touching the departments of statics and applied

mechanics as well as geology! So we decided to shift all the coal and so leave the engineers and stokers free to attend to the furnaces where they were somewhat shorthanded.

Never was such an incongruous set of coal trimmers.

Down in the hold a high official in the Indian Weather Service shovelled the coal into baskets, assisted by our motor expert (Day). A Cambridge M.A. (and the authority on whales) hoisted the basket with the help of a well-known New Zealand climber and stockowner. Ponting bent his artistic intellect to the work of unhooking the basket and throwing the coal through a door into the bunkers, and inside a



Trimming coal in the starboard main hold, March 7, 1912.

Thibetan explorer and the Physiographer to the Commonwealth "trimmed" the coal in the bunkers, packed it, and raked it level!

Simpson and I were busy comparing meteorological data before he took his notes back to India. I copied such memoranda as seemed to affect Australian weather. The "upper-air" results were very interesting. The balloon ascents showed that there is a gradual decrease of temperature with elevation in summer, but that in winter it grows warmer. Thus there is a tendency to approach the same temperature in winter and summer at high elevations. He recovered one record which had ascended nearly twice as high as Erebus, or five miles.

Priestley's log for the Northern Party showed that we at Cape Evans had been having calms while they, at Cape Adare, had experienced a twelve-days' hurricane!

One morning I visited the scene of the pump's disaster of December, 1910. There is a wooden shaft enclosing the two pump tubes and just large enough to enable a man to climb down a ladder at one side. It reached the bilge, and here the pump tubes dipped into the latter. Before the gale it was only possible to get into the shaft by the main hatchway. We inspected it by a lighted matchbox, for the electric lamp was out of order. Under the main deck and at the side of the engine-room was the hole * cut through the iron bulkhead during the great gale February 12, 1910, and then the pump shaft was entered by tearing off the side boards at Y. For it was impossible to raise the hatches and enter in the ordinary way. Now the nozzles were made removable, and the entry from the engine-room was kept clear, so that the same danger could not recur. The sounding rod was let down a tube in one corner of this well also.

On the 7th the temperature had been +7°, and now five days later we reached freezing-point (32°). Thus the weather was about 5° warmer for each day's run north.

"12*th March*.—I had a queer dream about the School of Geology at Sydney, which was quite consistent, and ended with some one going out and banging the door violently. . . . So violently that I awoke—to find the rudder nearly banging itself off with the heavy swell. It is funny how the sleeping mind adapts itself to real sounds!

"There was no wind, but we had most awful rolling, 41° from the vertical, so that the swinging lamp in my cabin is nearly lying on its side. My books sling off the shelves, my boxes come adrift, I was tossed across the cabin, and all the plates, etc., on the tables jump right over the fiddles! When we turned in I couldn't keep still, though jammed by my knees, toes, back, and head. I stuck in a drawing-board to prevent my being flung out, and got no sleep, but a stiff neck through using it as a strut."

Simpson amused us with some early recollections of Sunday schools. "How did Absalom die?" Loud chorus from the afterguard, "Caught by his hair and hanged."

* See sketch, p. 42.

A. B. CHEETHAM, WHO HOLDS THE RECORD FOR CROSSING THE ANTARCTIC CIRCLE.

G. C. SIMPSON, MARCH, 1902.

Simpson, "The Bible doesn't say so!" "Who was the oldest man?" *Frantic* chorus by aforesaid, "Methusaleh." *Simpson*, "No, Enoch, *his* father, because Methusaleh died before he did!" Then Simpson quoted an essay by one school. "Moses' mother was very cruel, and she put him in the bulrushes, when she got sick of beating him." Asked to explain this the boy said, "Well, isn't that what the Bible says—when she could *hide* him no longer?"

During the next few days we were busy writing the cables for the Associated Press, and I got Drake to type a report of the last western journey for Captain Scott (which he never saw). The hard-worked afterguard were now set to wash the wardroom! On the 15th I note—

"Day, Meares, and Dennistoun are doing a bit of charing. This morning Meares dropped a rag on me as I was working below and missed. Then Dennistoun asked me to pick it up, and as I looked up, got me in the eye. So I went for him, and scrubbed his face muchly with soft soap, amid hilarity."

At noon on the 16th we passed the Balleny Isles. We could see Buckle Island about thirty miles to the south as a snow-covered mountain occasionally showing through the clouds. Only one or two ships have been so close to these islands since they were charted by Balleny. We crossed the circle that evening, and celebrated it by another sing-song. Most of us sang something, Ponting's contribution with its refrain of "Boil—my mother" (a study in wrong punctuation) bringing down the house!

Very early on the 17th every one on deck was busy furling sail when MacCarthy suddenly spotted an iceberg dead ahead. Luckily we just had time to steer clear. We had been having "iceberg-watch" for some time now. I had been on duty from 12 to 2 a.m., though I could see nothing through the snow. The ship was going about five knots, and the white spume spreading from the bows was about all that was visible. A berg shows up merely as a greyish cloud under these circumstances.

There were many visible during daytime. At noon, for instance, we passed another much weathered, and resembling a decayed molar tooth. Possibly this resemblance is based on similar causes—a hardened outer skin cemented by spray, etc., and a softer core weathering from above.

I went on iceberg-watch again from 8 p.m. till 10. There was some snow again, and it was difficult to see anything. All this week we had been driving to the west, so as to pick up the constant west winds and sail on a slant up to New Zealand. We had only forty-seven tons of coal left now, and if we got blown past New Zealand with no coal—as was quite probable—it would take weeks for this bluff old whaler to beat back against head winds.

Poor old Nigger has gone overboard, finally we fear. We were all proud of our black Tom. He fell overboard on the last voyage, and luckily was seen manfully (or catfully ?) swimming along in the wake of the ship. The crew got out a boat, saved him, and were back in twelve minutes ! But no one saw the last tragedy. In the hold we found two rabbits having a thin time, and fed them on carrots and bread and milk. I don't know their ultimate fate. (There's a black welcome for bunnies in Australia, which I thought extended to New Zealand also.)

I can see the afterguard becoming regular sailor-men ! On the 20th we had another mutiny—about food this time.

The Mutineers. "When are you going to give us a change from this everlasting mutton, Frankie ?"

Store-keeper Drake. "Mutton's very good food."

Mutineers. "Why can't we have 'True-egg' omelettes ?"

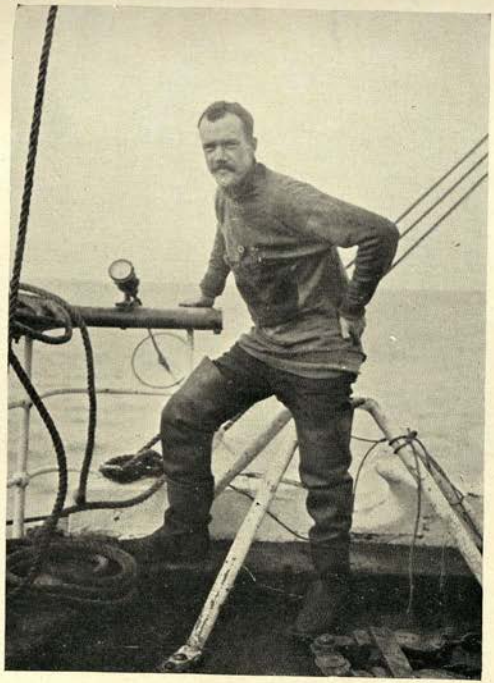
Drake. "Well, perhaps we could have that as an *additional* dish."

Mutineers. "Why *additional*, Frankie ?"

Drake. "Because Frankie doesn't like True-egg !" And he added, "If you want more *mutton*, just say so !"

(A very finished "cagger" is Frankie Drake.)

We had very variable weather during the last week or so of our voyage, and I give herewith the record of the worst gale ever experienced by any man on the *Terra Nova*. My journal suffered in consequence, but I will copy my notes written just after the gale, *verbatim*. First of all, here is a copy of the ship's log for the worst days of the gale.



A VERY "ORDINARY SEAMAN."
(The writer.)

PENNELL ON BRIDGE.

1912.	Distance.	Max. speed.	Course.	Wind.	Force.	Sea.	Barom.	Temp.
March 22								
a.m.	50	5·9 at	N.30W.	S.	7 } gale	7	28·99	30·8
p.m.	59·5	7 a.m.	N.7W.		8 }	8	—	37
March 23								
a.m.	37	5·6	—	W.S.W.	8 } gale	8	28·78	37
p.m.	48	noon	—		9 }	9	—	—
March 24								
a.m.	52	5	N. }	S.W.	8 } gale	8	28·73	40
p.m.	57	7 p.m.	N.N.W. }		10 }		—	—
March 25								
a.m.	49·5	4·8	N. 22 }	S.S.W.	9 to 11 } gale	9	29·03	37
p.m.	48·3	noon	W. }		8 }	8	—	43
March 26								
a.m.	25·1	3·4	N. 50 }	S. by W.	7	7	29·66	42·2
p.m.	Becalmed.	7 a.m.	W. }		2	5	—	44·5

"*26th March.*—It is now 12.40 p.m. We have had a satisfactory lunch of roast mutton and treacle duff (*toujours mouton !*). It is nearly calm, and we have all sail set, and are hurrooshing along at nearly two miles an hour !

"I am five days behind in my diary. We have had a pretty sudden gale—the worst ever felt by any one on board, I believe. It culminated about midnight on the 24th or 25th. For several days it had been blowing almost storm-force from the S.W., and so helped us along O.K., though rather too much westerly, and we could only drive along in front of it. With three stormsails (main lower topsail, fore lower topsail and inner jib) we went along for days at five miles an hour.

"On the evening of the 24th Day and I had First Watch. I was told off to assist Pennell from 10 to 11 p.m. I put on my paraphernalia and turned out on a wild stormy night, after prolonged bumping in my bunk for three or four hours. It was awful on deck, the ship mostly with her lee scuppers under water, and kept there at a constant heel, with only three small stormsails. We were running before the gale (an unusual experience nowadays, as Penelope cheerily pointed out !), luckily just on our course. To windward (in south-

west) the sky was covered with gloomy clouds—several black bows, which always mean squall-storms, being hideously apparent! White horses raced past the bows, and were all one could see in the darkness. They looked just like detached floes! The whole time we had to clutch the bridge rails to prevent our rolling down to leeward.

"Then the sky got darker all over, the stars disappeared. A sudden squall hit us, and then the shrouds started shrilling and booming. The canvas screen on the bridge bulged in; your nose nearly blew off your face if you looked over it, while the canvas made eddies which deflected the wind into your face.

"The ship plunged forward into the black, sometimes partially righting, but mostly lying over at 30°. Then the black squall passed (in about ten minutes) and a patch of clear sky showed to windward. Another squall-bow appeared, and we were battered and driven over again. This lasted longer, about twenty minutes. Penelope asked me to go to the standard compass (near the foremast) to check the steersman. I got the electric torch and managed to crawl on to the ice house which supports the compass. Up a silly little ladder with no grip, and in flapping oilskins to find Rennick there before me. Then I had to crawl round and see that the helmsman was keeping his course. I clutched at his screen-posts and wondered if they would blow overboard next gust. (The screen went over next day!) About 10.40 a thick black cloud enveloped the horizon to the west and gradually reached us. This accompanied a squall where nature fairly burst her bounds! The sea was blown flat, and the air filled with horizontal hurtling arrows of sleet and water. I didn't know that wind could show such malignancy! Don't know how the storm-sails stood it, I suppose because the rigging would do for a ship about twice this size! It was a snorter. Couldn't see more than a hundred feet, though there was no snow in the air. Just solidified wind, I guess.

"If the sails had not held it would be called force 12—the maximum, as it is they are content with force 11. Penelope said he enjoyed this sort of thing, but I can't say I was thrilled with enthusiasm, and I preferred to be where the hurricane force was not quite so obtrusively obvious! So

at 11 p.m. I unselfishly called Bernard Day for his share of the hell-broth, and went down below to try and forget it in sleep."

It culminated at 3 a.m., when the starboard whaler was torn from one davit. Just as they got a rope under the loose end the other broke loose. So they cut it adrift after it had been bumping on the ship's side for some hours a few inches from Lieutenant Evans' sick-bed!

Bernard Day was nursing Evans, who was progressing satisfactorily, though still very weak. However, by now he was nearly as cheerful as usual, and his cabin was chiefly noticeable from the amount of laughter emanating therefrom. He had onions, oranges, and beer in excess of our ration, and got up for a few moments just before the gale.

"Now that the engines are stopped (to save coal) we have to use the hand-pumps continuously—about a quarter of an hour each four hours. In the storm, owing to the rolling, it takes longer, for the well only fills slowly through its small holes, and most of the bilge lies on the lee side.

"The pump-handles (across the waist) are left on all the time now, and with 'life-lines' they make something to grip as you sidle along the deck. Ponting didn't see the handle, and running to dodge a big wave he was knocked silly by a blow on the brow. Result—two lovely black eyes, and a thankful heart that his nose wasn't broken!"

The same day a big sea pooped the ship and covered the steersman (MacCarthy) in fifteen feet of water! It broke down the canvas screen protecting him, but didn't dismay MacCarthy. He had bad luck later, also. For climbing the ratlines to free some tackle his helmet was knocked off. It nearly came inboard on an incoming wave over the lee bulwarks, but not quite. However, all that cheery MacCarthy said was, "Maybe 'twill make the gale lessen a bit!"

There was naturally not much comfort anywhere on board, not even in the cabins. I think the following extract speaks for itself—

"My bunk is just over the counter, where the waves bump every few minutes, just over the screw; just under the chilled feet of the steersman who dances on the deck, which is like a sounding board; and just next the rudder, which has two dozen squeaks and groans of its own. Add to this rolls varying from 30° to 50° each way.

"I have made a fine hanging candlestick from a chain of safety-pins and a bent wire, and this swings out and bangs my head. I stick in my drawing-board at the side of the bunk, and so try to get some sleep in the fearful rolling.

"There I lay, throughout the day,
Lying this and then that way,
Pain and cramp from toe to shoulder;
Up and down the tempest rolled her.
Pitch and toss, athwart across—
Never worse befell old Ross.
Waves belched round, above, right over
Poor old storm-tossed *Terra Nova*."

On the 26th we had discussion of Amundsen's chances, and I got Pennell to draw a map of his winter quarters. This has some interest, as we did not know anything of his movements for over a week yet.

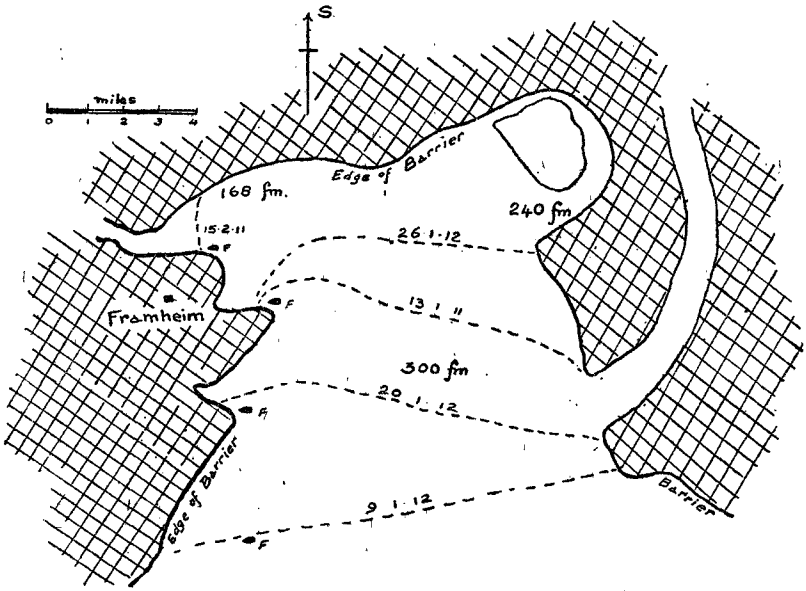


Chart of Bay of Whales, 78° S. + 164° W., after Amundsen.

"The *Discovery* in 1902 found several deep bays in the edge of the Ross Ice Barrier. Balloon Bight went in about ten miles. Shackleton in 1908 found that these had merged into one and he was stopped by sea ice at the head.

"Pennell in the *Terra Nova* found Amundsen's Hut (in February, 1911) to be about two miles from the water on a ridge of old sea-ice about thirty feet high, but hidden from the ship by another ridge of the same nature.

"To the west was an indifferent lane half a mile wide which reached *behind* the hut. Here the sea-ice was only a few feet above the water except where pressure occurred. The ice in the west of the lane was breaking out. Behind this about four miles off was an eighty-foot cliff of Ice Barrier with a path up in the south-east. I wouldn't like his winter, though if he lasted through the autumn he might be O.K. afterwards. Anyhow, we'll know in about a week now. We had a great cag to-day. Some are still sure that Amundsen did nothing at the Pole. The arguments are: (*a*) Amundsen never liked sledging; and (*b*) if he meant to go up another glacier than the Beardmore, he'd have acquired merit and said so!

"Contrariwise (*a*) if he found going easy he might have prospected up an easy one, perhaps in 1911; and (*b*) if he'd gone astray, the *Fram* would have come to us to investigate this year."

"On the 27th we finished off the cable. It runs to 7,500 words, of which the western party contributed 900. It is to be delivered to the agent at Akaroa on Monday (first of April). A funny day to send off a big cable, but it won't be published till the 2nd in England, and ten hours later in Australia. Meanwhile we loaf about till Wednesday morning (minimum 36 hours), and then land at Lyttelton as soon as possible."

On the 30th the coal gang put in about six hours filling the bunkers, so as to rest on Sunday. We shifted seven tons. The gale had rounded the large lumps of coal, the impacts turning them into egg-shaped boulders. The coal-dust was packed into a hard layer which we could hardly break out with a pick! This is what clogged the pumps in 1910, and in that gale Teddy Evans was head and shoulders under the bilge water groping for the mud clogging the pump-roses.

During Sunday we slowly cruised towards Akaroa. After lunch we sighted a school of eight sperm whales. We turned off and followed them. Mostly one saw their broad rounded brown backs. Then one would raise his head a little and blow off "steam," not up straight but diagonally forward.

Sometimes their large triangular tail fins showed, and once or twice the huge torpedo head appeared above water. Our harpoon gun was out of order, but they were too shy to let us approach within striking distance. Each of these whales was worth £300, so that there was a small fortune in the whole school.

Monday, April 1.—About 6 a.m. we approached Akaroa. It was a bright morning as we entered the very fine harbour, the Heads reminding me of those of Sydney. We could see the friendly light of the lighthouse twinkling a greeting to us. Then we saw ragged clumps of the first trees—two on the skyline resembling a pair of roosters fighting, and sheep, like rabbits, browsing on the steep hillsides. We lay about a mile off the little town, while Pennell and Drake went off in the cutter and were met by a launch. All communication was forbidden with the shore, but later two men in a small launch hovered around us. As they pushed off they called out—

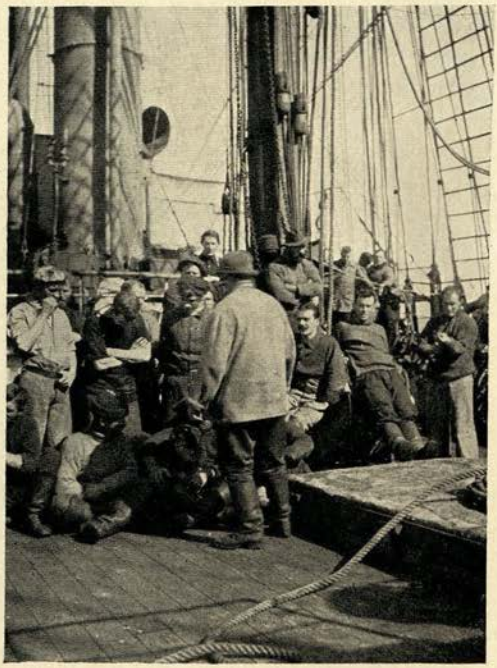
"Why didn't you get back sooner? Amundsen got the Pole in a sardine tin on the 14th December."

"Pennell returned about 11 a.m. and confirmed it. Amundsen has done wonderfully. His risky hut-site was not so bad as we expected. In place of howling blizzards four days in each week, he seems to have had calm weather! But his bold dash up another glacier, his getting five men there, and his nice behaviour after returning with regard to Scott and his work have changed our opinion of him *in toto*.

"Scott will have reached the Pole about January 16. When he sees the tent and flag there he will get a most unpleasant shock. Amundsen started eleven days before Scott and was eighty miles nearer. He got there only thirty days sooner, so that he didn't march much quicker.

"In the west Gran and I agreed that he had a very good chance, and Gran has written down in my sledge diary the day he (Amundsen) would get there. I haven't looked at it, but believe he was at the Pole at the day Gran said!"

This prophecy has aroused some interest among psychologists at home! So I will explain the circumstances. Gran woke up on December 20, 1911, when we were camped in the Punch Bowl and had been sledging over a month. He declared that he knew that Amundsen was turning back. As natural we pooh-poohed this. He said, "Well, I'll write it



PONTING IS HERE ARRANGING THE CREW FOR A PHOTO OFF AKAROA. PROBABLY HIS LAST EFFORT AT "PONTING" ANY OF US.

The dog Tsignan in the foreground.

LIBRARY OF THE BOMBAY BRANCH OF THE ROYAL ASIATIC SOCIETY

down in Grif's book here." He did so ; but in my Browning and not in the diary (as I say above).

This copy of Browning was left on Cape Roberts with all other non-essentials on February 5. It remained there until picked up by Priestley, six months after I had reached Australia. It was restored to me in Priestley's home at Tewkesbury in 1913, nearly two years after Gran's inscription. I looked through it and came on Gran's note, which I here reproduce. This is one of the most extraordinary coincidences I know of, and owing to Gran's isolation from *all* outside information is perhaps unique.

I am personally of opinion that coincidence and not telepathy is involved ; though it is a fact that Gran never made any other attempt to get an undoubted record of a dream, and he certainly believed this to be something supernatural at the time !

During Monday we idled off Akaroa. Some fish were caught, Day hauling in a huge barracouta and Evans a rock cod, which he caught as he was sitting in a deck chair, and so celebrated his first day out of the cabin. They tasted good at lunch ! We trimmed eight tons of coal during the day, so that only five were left ! Then I had a huge bath, borrowed a shirt, and got into clean clothes ready for civilization !

On Tuesday I packed all my gear, which was lucky, for I only had half an hour to catch the Sydney boat finally. On Wednesday morning we entered Lyttelton Harbour early in the morning. A tug came to meet us, carrying Mrs. Wilson and Mrs. Evans. Pennell asked me to steer the ship into harbour—why, I know not ; unless he thought I looked too respectable and might look more natural after a trick at the wheel. However, one of the seamen did all the heavy brain work, and I merely assisted at the tricky corners !

Simpson, Meares, and I hurried for the first train to Lyttelton. Simpson was not specially noticeable except for his ski-boots, I had on his shirt and Evans' cap. Meares was clothed in a suit lent by Jim Dennistoun, who said it was an old one of his father's. I think Meares' departure was hastened by the advance of Mr. Dennistoun senior to greet his son !

I spent only one day in Christchurch, for finding that a ship left for Sydney that evening, I transhipped all my gear to the mailboat and was back in Australia on the 7th April, 1912.

VIII

THE END OF THE EXPEDITION

THE END OF THE EXPEDITION

I HAVE brought the story of the Expedition up to April, 1912, so far as my own part in it is concerned. But it will be of interest to give a brief *résumé* of the much more arduous journeys of the other divisions of the Expedition.

Let us consider the distribution of the *personnel* in the middle of December. In the far north at Cape Adare, Campbell and his five mates were awaiting the arrival of the *Terra Nova* to take them to fresh fields of work. The sea-ice had blown out early in spring, and they had been cooped up on the rocky promontory unable to explore the hinterland, just as had Borchgrevinck ten years earlier. The ship was not due until early in January, but Levick's penguin studies and Priestley's ice-notes testify to the industry of the scientific staff during their imprisonment.

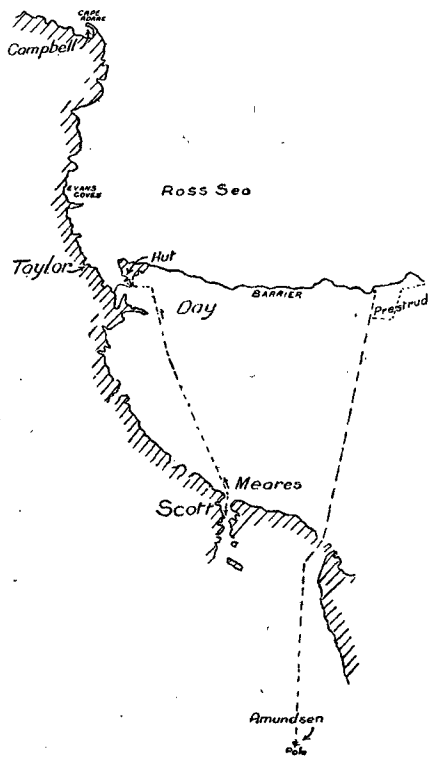


Chart of parties, December 14, 1911
(Amundsen reaches the Pole).

Further south my own party was preparing to climb the Mackay Glacier, as recorded previously. We were to be taken north on the ship to Evans Coves (to spend five weeks

there during January and February) as soon as the *Terra Nova* could reach us.

At Headquarters Simpson was completing his meteorological log—certainly the most valuable record of Antarctic weather which has yet been obtained by any of the numerous expeditions to the southern continent. Ponting was living at Cape Royds, and obtaining many of his most successful studies of animal life.

To the south stretches the Great Ice Barrier, and somewhere off White Island a party of two men are doggedly pursuing their homeward path. They are dragging a queer contraption—a sledge burnt in half—and each night have great difficulty in erecting their four-man tent. Neither Day nor Hooper understands navigation, and their plight, if they miss one of the old pony shelters, will be pitiable. They lie up during a heavy blizzard, and then start off, desperate, through the drifting snow. They arrive safely, and a few days later, returning on their path, see their blindfold tracks passing along the narrow ridge between two huge crevasses!

Another stage of some two hundred miles shows us, at the foot of the Beardmore Glacier, a second supporting party, which has just bidden farewell to Captain Scott. Meares, with Demetri and the dog-teams, is proceeding north again for his last journey on the Great Ice Barrier. For three months he has been forwarding stores ahead of the pony parties, and now the Pole party pushes on, unsupported by ponies or dogs, on the two hardest stages to the Pole.

Scott has just finished the hardest day's work he experienced on the ascent of the Beardmore. "A most damnably dismal day," he calls it. Next day, the 14th—which is that on which all the positions in the preceding figure have been charted—they begin to reach better surfaces, and the three parties, under Evans, Bowers, and the leader, swing along at an encouraging rate.

Far to the south—indeed, at the uttermost south—five Norwegians have reached their goal: Amundsen, Bjaaland, Hanssen, Hassel, and Wisting. After a few days' rest they have verified their position, and made sure of the Pole by a circular journey round the apparent site. And now they are preparing to return to Framheim and the north.

Prestrud, Amundsen's lieutenant, has just carried out his

trip to King Edward VII. Land. There, beyond the Barrier, he reached high land. Rocky cliffs appeared in a few *nunatakker* above the snow mantle. To these they gave Scott's name.

The next chart shows the position of the parties on the 18th of January, 1912. Cape Adare is now deserted. Campbell has been picked up by the *Terra Nova*, and safely landed at Evans Coves for five weeks' exploration between Mount Nansen and Mount Melbourne. Then the ship sails south to pick up the western party at Granite Harbour, and to communicate with Headquarters. The pack-ice is still solid in MacMurdo Sound; the ship can do nothing till well into February. The western party are waiting on Cape Roberts some twenty miles from the ship. As narrated previously, they realize that there is no hope of relief in that quarter, and later march overland to the hut.

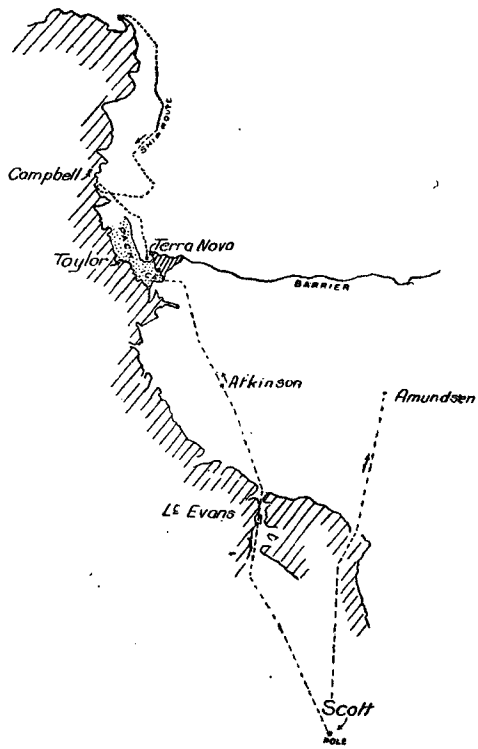


Chart of parties, January 18, 1912
(Scott reaches the Pole).

Day and Meares have reached the hut, and Atkinson is now halfway home across the Great Barrier. They have had an anxious rush to keep the balance between food and time. Only one day—Christmas—has been different from the many weary days of sledge-hauling. Among the moraines near the "Cloud-maker," Wright discovered a piece of marble containing the first large Archæocyathine fossil from Antarctica. Although vastly larger than Shackleton's specimens, this is only a centimetre long!

Lieutenant Evans has now also turned northward, and, with Lashley and Crean, is nearing the foot of the Beardmore. For him worse troubles are approaching. Worn out by constant sledging and unsuitable food, he is attacked by scurvy, and only saved by the gallant devotion of his naval mates.

Captain Scott has accomplished his task, and within the time he had allotted to it. Realizing that if Amundsen came successfully through the winter his methods must be speedier than those of the English party, Scott proceeded steadily along the lines he had decided upon when he left England. It was a bitter disappointment. Since Amundsen had reached the Pole the year 1911 had passed away; and so the record stands: "The South Pole: Amundsen 1911, Scott 1912." How few will realize that but a few weeks intervened between the two achievements!

Meanwhile the Norwegian is speeding back to the *Fram*, and already the hardest part of his journey is over. In mid-January the conditions of the Barrier bear no remote resemblance to those in mid-March. No one who has not experienced it can picture the enormous difference due to the lapse of those two months.

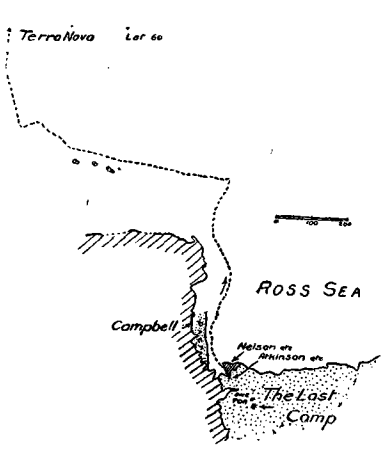


Chart of parties on March 21, 1911 (the last camp).

The third chart shows the scene of the last tragedy. Far to the north the ship is nearing civilization. Campbell's party is isolated at "Hell's Gate," their cheerless home at Evans Coves. Here in a hole in the snow they wear out a weary existence for eight never-ending months. No other Antarctic party has ever experienced such a test of courage and endurance. Even Mawson's three weeks alone gave less opportunity for utter despair than the life of these six men from March to October, 1912.

All communication is now cut off between Cape Evans and the Barrier. At the 1910 Hut are Nelson, Debenham, Wright, and Gran with some of the men, and fourteen miles

south in the old *Discovery* Hut are Atkinson, Cherry-Garrard, Keohane, and Demetri. But two of these are invalids—worn out by wild weather on the Barrier when they carried further supplies to One Ton Depôt.

Eleven miles south of this depôt—and just beyond where Bowers and Gran reached in the depôt trip of February, 1911—is the last camp of the Pole party. All the world has been moved by Scott's messages from this formless yet historic site. It would be presumption in me to try and describe it.

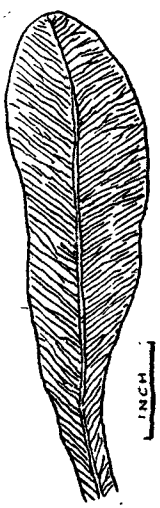
Why did the tragedy occur? I am convinced that no reason beyond that of Seaman Evans' illness is required. When Wilson was coaching us as to how we should meet the hazards of Antarctic sledging, he told us of frostbites, chills, blizzards, and so forth. I said that these seemed surmountable, but I added, "What are we to do if one of the party breaks his leg?" which seemed by no means impossible in the rough rocky region before us. Dr. Bill replied, "Well, you will have to make a more or less permanent camp, kill plenty of seals, and wait there until you are relieved, or until the leg is usable again." Two factors were vital—rest for the invalid, and seal-meat for the party's sustenance. When Evans met with his accident, there could be no rest for any, sick or well. It was a race with famine, in which only strong men had any chance. There was no need for a severe accident to handicap the party hopelessly, as in the case of Dr. Mertz. A slight ailment rapidly becomes mortal. A sick man must be kept warm, and in the Antarctic the only warming agent is the human one. Very literally a man "keeps himself warm" with the most wonderful furnace in nature—fed with fuel in the form of biscuits and pemmican. And so, I believe, that, short of abandonment, the party had no hope with a sick man on their hands. Scott and Wilson would remember, however, that they had managed to bring back Shackleton to safety in 1903, and would hope to do the same again, even though the distance was four hundred miles instead of a hundred and fifty.

With each hour's delay each man grew weaker. Each day the weather grew worse than the preceding. The sun now sank below the horizon at night and the Antarctic cold, unopposed by his warm beams, spread resistless through both

animate and inanimate nature. Each night was longer, each march a harder fight against the blizzard drift.

I used to wonder how Shackleton managed his wonderful feat with an unsupported party. He told me that he would never have got through if it had been calm, nor if the wind had been but a trifle different. For days, on their return Barrier journey, they were marching through drift which did not rise to their eyes and so block their view; but was due to a southern blizzard wind just strong enough to fill their sail and push them to the north. Captain Scott met with no such fortune. He was a month later than Shackleton, and when Oates fell sick their chance had gone.

I do not believe that unaided the three men would have survived even if they had reached One Ton Depôt. There was no chance of thorough rest there, and nothing else could have saved them. At their slow rate of marching they were still ten days from Discovery Hut, and such a period of exposure would have been too much for them. Their journey was a supreme struggle against all the powers of Nature, and when all human effort had been expended they succumbed, winning a deathless renown which has aroused the envy of all brave men and the admiration of the world.



Glossopteris, a Permo-Carboniferous fern from the Upper Beardmore Glacier.

On their last few marches, when everything was fighting against them, they kept the specimens gathered by Wilson at the head of the Beardmore Glacier. Scott writes, "The geological specimens carried at Wilson's request will be found with us or on our sledge." It is pleasant to think that these specimens, which must have a greater sentimental value than any others of their kind, have also a greater scientific value than any hitherto obtained in the Antarctic. At the Australian meetings of the British Association Professor Seward gave two lectures dealing with the fossil leaves which they contained. Perfect examples of the fern-like plant *Glossopteris* were preserved—closely related to those occurring in India, Australia, South Africa, and South America. In fact, this plant is the emblem of the ancient

continent of Gondwanaland; and the Polar specimens give positive and invaluable evidence of the condition of the world in Permo-Carboniferous times, of a sort which can truly be called epoch-making.

I can here give no account of the doings of the small band during the last months spent by the expedition in Antarctica. The record of the survey of Erebus by Priestley and Debenham and of the search for the Polar party can be read in other volumes.

However the world knew nothing of this disaster until the ship returned in February, 1913. Remembering the pleasure I had felt from Professor David's gift of "Queed," I sent down a few books by the ship in the preceding December. In each case I tried to suit the recipient's taste. Thus Nelson received "Queed" (Harrison); to Wright I sent "Marriage" (Wells); to Cherry "The Dreadnought on the Darling," in memory of his Australian travels. To Debenham and Uncle Bill I sent books in the writing of which I had had a part. To Bowers (in the character of "Farmer Hayseed") I sent Bean's fine book "On the Wooltrack"; and to Priestley, "We of the Never Never" (Gunn). Atkinson, I hope, had a fellow-feeling for pugilist "Shorty McCabe"; while Oates would have been carried back to Africa by "The Dop Doctor." I knew Rex Beach would attract Gran—so he was furnished with "The Silver Horde."

I was carrying out a geological survey at the Federal capital, and in the solitary evenings I managed to pile up a huge budget of letters for my returning mates. Some of them, alas! were returned unopened.

In February Bernard Day reached Australia and was in Sydney with me when we heard the sad news. I had never anticipated any serious accident to the Pole party—chiefly, I expect, because Shackleton had managed to pull through safely. But I should not have been surprised to hear of disaster in Campbell's northern party, for no one had lived through a winter in such fashion before.

A solemn service was held in the Cathedral at Sydney, and later at a meeting to initiate a memorial fund, Professor David gave an eloquent justification of Antarctic exploration and paid a touching tribute to the characters of the lost men. As a

result of similar appeals in this and other states, the Empire contributed most generously to the Captain Scott Fund.

The Federal Government kindly granted me leave to collaborate with the scientific members in London; and Priestley and I returned home in the *Mongolia*. We arrived in London in time for the Albert Hall meeting in May. Commander Evans here described to the large and deeply interested audience the chief features of the 1910 Antarctic Expedition.

The office in Victoria Street was the rendezvous of the surviving members of the Expedition, who were nearly all reunited within the next month or two. Simpson was too busy in India to visit England, Day was in Sydney; but with these exceptions we were all present at Buckingham Palace when the King's medal was presented in July. The men under Lieutenant Rennick marched from Victoria Street, and joined the officers in the Palace. Here we were marshalled in three lines—naval officers, scientific and other officers, and seamen. Lady Scott and Mrs. Wilson, Mrs. Bowers, Mrs. Evans, and Mrs. Brissenden,* were received first by His Majesty. The others were presented by Prince Louis of Battenberg, and as each advanced the King shook hands, gave him the medal, and said a word or two.

We returned to the Caxton Hall, and after drinking some farewell healths, the expedition, as a whole, was disbanded.

But the scientific work will take several years to complete, and thanks to the generosity of the public, the means for carrying this out are adequate. No less than £75,000 was placed at the disposal of the Committee, while in addition to this the Government is paying out various sums from the Pension Fund.

Some £34,000 was allocated from the Public Fund to the widows and dependants of the lost explorers. A bonus was paid to the officers and men; the debt of the Expedition was paid, and £17,500 was set apart for the publication of the scientific results.

Some £18,000 remains for a memorial to the men who died. Of this amount half will be expended on a suitable monument, which will probably be placed in Hyde Park, and on a tablet in Saint Paul's. The balance will be devoted to

* Brissenden, one of the seamen, was drowned in New Zealand.

an endowment fund in aid of future Polar research. "This is an object which it is believed would have commended itself greatly to the late Captain Scott." So concludes the report of the Mansion House Committee.

This narrative began amid the Colleges of Cambridge, and may very fittingly close there. Dear Uncle Bill will never return to his rooms in Caius College; but on the old archway through which he reached his quarters, are blazoned the names of Wright and Debenham. For Debenham has joined Caius, and "keeps" just below his sledge-mate, between the the Gates of Wisdom and Honour.

In a spacious room in the Old Court of John's, Lillie ponders over problems of Antarctic Biology. Priestley is a Fellow Commoner of Christ's, and for a time I had diggings in the Hostel at Emmanuel. Priestley and I "kept" almost next door to each other, and almost always had our meals together; and during the day Debenham joined us in the huge "Antarctic Room" in the Sedgwick Museum. Here the specimens from the South were labelled, sectioned, and described. Here often appeared Wright and sometimes Lillie, while Pennell, Nelson, Atkinson, and others visited us not infrequently.

The various researches are being carried out under the supervision of the British Museum authorities, while Captain H. G. Lyons is acting as general editor of the scientific publications.

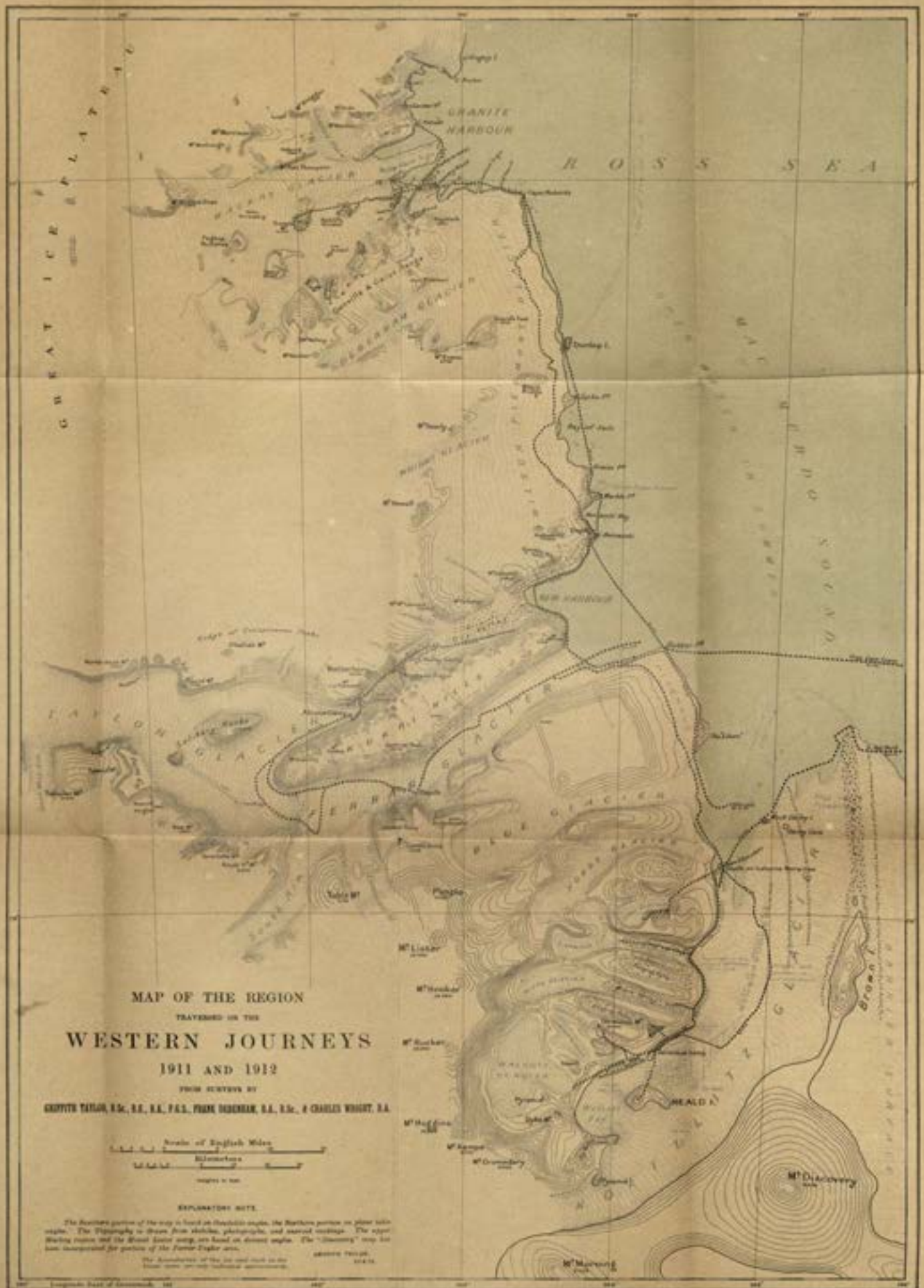
I have finished. In this account I have tried to show that a Polar expedition is a microcosm in its own peculiar way. Here are labours of a strenuous type, but not insuperable in the main. Here are dangers which the city dweller never meets, but which lose half their terrors with familiarity. Here are pleasures—like the labours and the danger—more concentrated than those met with in times of ease. Here, lastly, is fellowship, which is the chiefest charm of exploration.

It is a truism to declare that friends of the sledge-trace and sleeping-bag are friends for aye. My mates, in the 1910 Expedition, have forged yet a closer bond for our future sledge journeys. When this cruel war is past, we trust that Priestley will join forces with a relative of Debenham's, while Wright and I have started anew on life's journey with Priestley's sisters to help us in the traces!

I shall, in all probability, never again see the Antarctic; but my advice to any volunteer, who has that opportunity offered him, is to take it. Especially is this the case if he be a scientist or writer, for the present tendencies of modern life are all opposed to the multiplication of such experiences. Only in Polar lands is to be found the joy of a "real return to the primitive," in association with the best types of strenuous youth. There, if anywhere, is life worth while, and effort sure of recognition. To few explorers is it given to serve under a leader with Scott's kindly sympathy for every detail of his work; but after each and every expedition, the heavy cloud of discomforts, dangers, and disaster gradually fades from memory, and nought remains but the brightness of the silver lining.

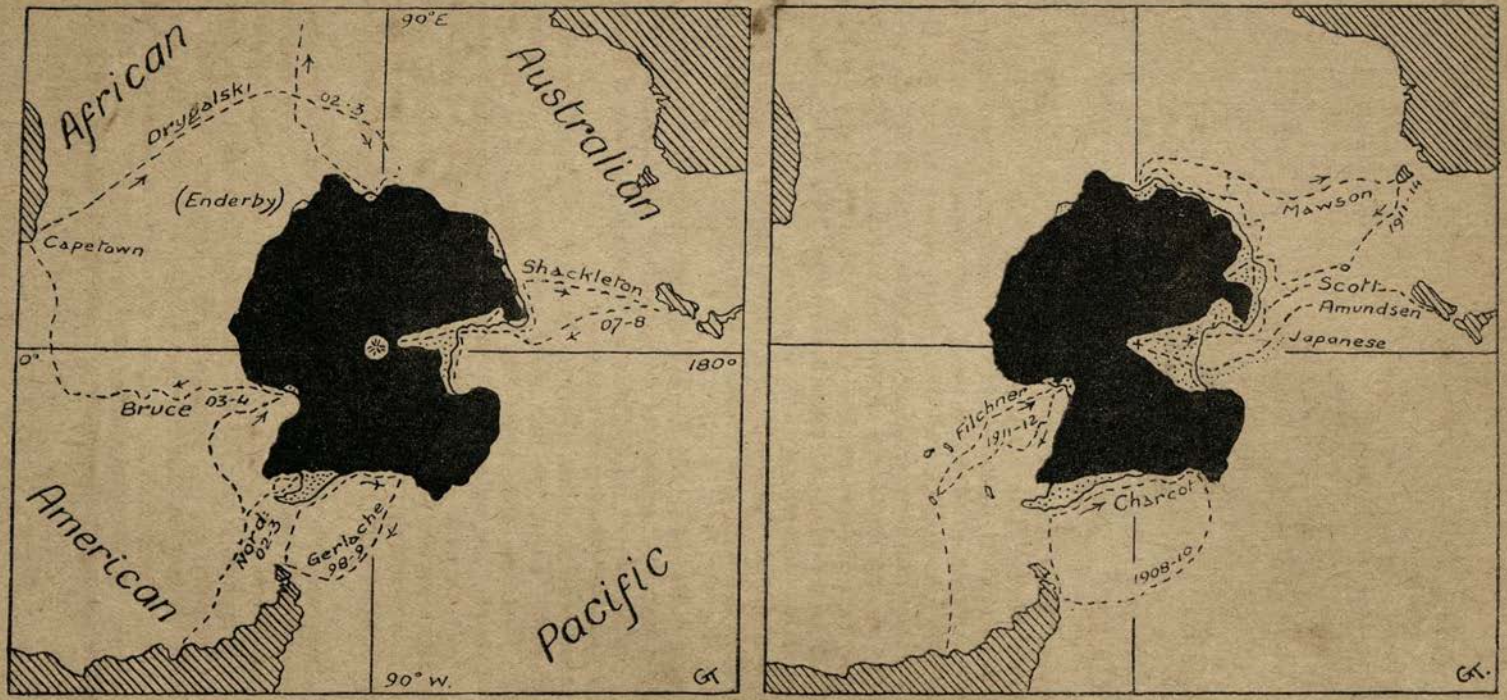
LIBRARY
OF THE
BOMBAY
BRANCH
OF THE
ROYAL ASIATIC SOCIETY

MAP OF THE REGION
TRAVERSED ON THE
WESTERN JOURNEYS
1911 AND 1912
FROM SURVEYS BY
GRIFFITH TAYLOR, B.Sc., B.E., B.A., F.G.S., FRANK DEBENHAM, B.A., B.Sc., & CHARLES WRIGHT, B.A.
Scale of English Miles
Kilometers
EXPLANATORY NOTE
GRIFFITH TAYLOR
ROSS SEA
GREAT ICE PLATEAU
GRANITE HARBOUR
NEW HARBOUR
Mt Discovery
Mt Morning
Mt Lister
Mt Hooker
Mt Hodgkin
Mt Hamper
Mt Crossbery
Pumpkin
Table Mt
Brown I.
Longitude East of Greenwich


MAP OF THE REGION
TRAVERSED ON THE
WESTERN JOURNEYS
1911 AND 1912
FROM SURVEYS BY
GRIFFITH TAYLOR, B.Sc., B.E., B.A., F.G.S., FRANK DEBENHAM, B.A., B.Sc., & CHARLES WRIGHT, B.A.
Scale of English Miles
Kilometers
EXPLANATORY NOTE.
GRANITE HARBOUR
ROSS SEA
GREAT ICE PLATEAU
TAYLOR GLACIER
FERRAR GLACIER
BLUE GLACIER
NEW HARBOUR
HEALD I.
Mt Discovery
Mt Morning
Mt Lister
Mt Hooker
Mt Huggins
Mt Kempe
Mt Cromwell
Table Mt
Brown I.

APPENDIX

RECENT AND FUTURE EXPLORATION



Period 1898–1908 (based on H. R. Mill).

Period 1908–1914.

Recent and future exploration.

APPENDIX

RECENT AND FUTURE EXPLORATION

HUGH ROBERT MILL has given a masterly account of Antarctic Exploration in his work "The Siege of the South Pole." He deals fully with the voyages which took place before Shackleton's great exploit. I have found it so difficult myself to get a comprehensive idea of the later expeditions that I have drawn the two charts shown herewith. If we divide Antarctica into four quadrants (as shown in Fig. A) we see that no expedition among the eleven charted has attacked the African quadrant, and only two (Amundsen and Charcot) have explored the Pacific quadrant. A survey of these maps shows that two great problems as regards the sixth continent are still unsolved. First, Is there a low-level, ice-covered strait connecting the floating Barrier seen by Filchner in the Weddell Sea with that crossed by Amundsen south of the Ross Sea?

In a paper published by the Royal Geographical Society in October, 1914, I have advanced arguments in support of this possibility. We hope that Shackleton, in his forthcoming journey between Filchner's and Scott's bases, will answer the question.

The other problem deals with the character of Antarctica to the west of Enderby Land, for the whole coast-line south of Africa is unknown. One can only hope that some future leader following Mawson's example will set aside all idea of transcontinental journeys, and devote his energies to detailed coastal surveys, which are infinitely more profitable from the purely scientific standpoint. However, under present political conditions there is little chance of any extensive work succeeding Shackleton's present enterprise until several years have elapsed.

I have, however, felt that it would be useful to collect the results of my experiences in the Antarctic in so far as they touch details of scientific equipment. These may be grouped under the following heads: (1) Personnel; (2) Tents and Sledging Stoves; (3) Note-books; (4) Instruments; (5) Cameras; (6) Clothing; (7) Food.

Personnel.—It may be that I am prejudiced by training, but to my mind these *coastal* parties should consist essentially of geologists, who must be capable of using theodolite and plane-table. The refined knowledge of an expert navigator or surveyor is wasted in such a

journey, where only the lunch hour or evening halt is available for a hurried "round of angles." The recognition of topographic forms should be a specialty of modern geologists, if they have had an adequate physiographic training, and (again, *me judice*) this is more probably found in the geologist than in the naval officer or professional surveyor.

It is unnecessary to point out that a biologist—whether botanist or zoologist—would be wasted on such a journey. Most geologists, however, have studied some botany and zoology, and are capable of collecting such mosses and lichens, etc., as they may come across, and with a little advice can make useful notes on the types and habits of the fauna encountered.

(I am not here referring to the *Plateau or Inland journeys*, where the main essentials in an explorer are a knowledge of navigation on trackless plains, such as naval men obviously possess to a high degree, coupled with indomitable pluck and endurance, in which they also have an unrivalled record.)

Too little stress has been laid on ability to take successful photographs and to make numerous sketches. The latter is all-important. With practice quite valuable sketches can be made in quarter of an hour, which are far ahead of any verbal description.

Outside these qualifications nothing is so essential as a cheery temperament. It is worth more than strong biceps, for the latter develops *en route*, while humour has a tendency to become diluted after four months' stiff sledging. Certainly the latter is not an ideal environment for its birth and growth.

Equipment for Scientific Coastal Exploration.—So far as the sledging outfit is concerned, it would be difficult to improve on that provided on Captain Scott's Expedition. But I am sure that a dog team would have enabled us to do twice as much work while along the coast. They could, I feel sure, be left tethered at the coast for a week or so, while inland journeys were made, with some provision of seal meat. Probably they would eat all the food in the first few days, but in the warmer summer months they could (and have been known to) exist without food for many days after such a gorge. Seals are very abundant in December, January, and February. For instance, in New Harbour we saw two herds totalling about a hundred individuals.

Iron Runners were undoubtedly of immense assistance to the Northern party on *sticky* sea ice. We tried them on rugged glacier ice and they were useless, for they had no "grip" at all, and on any sort of slope would not follow the traces, but simply slid down the "dip" of the ice.

Tents.—The larger floorcloth was much preferable where many instruments were carried. I should make it the full size of the tent-floor and shut out all snow. In the ordinary pattern there was over a foot margin inside the tent. A small tomahawk would be very useful for cutting up seal meat. We had none. Also one of Priestley's small ice-picks would be well worth carrying if there were the slightest risk

of being abandoned, even for a month. The ice-axes were not often used for their legitimate purpose of chipping steps. They were certainly valuable as supports on the slippery glaciers, but should have been stronger, even if it added a few pounds to the load.

The *Blubber Stove* was worth its weight in gold. It was made by Day, of sheet iron, and was simply a rectangular box, 18 inches long, and about 10 by 10 inches in cross-section. A round hole (about 8 inches in diameter) was cut in the top. A chimney of sheet iron, about 3 inches diameter, was riveted in one end, and was about 4 feet high; but we found that the length was not essential, as there was always sufficient wind to make about 18 inches of chimney act.

The only objection to Day's pattern was the door, which occupied the other end of the oven and was hinged at the top. It would have been better if the opening had been stiffened and the door also, so that it would shut readily, even when the oven was warped and dinted.

More important still, there should have been a "sill" at least one inch high to keep the blubber oil from all escaping from the floor of the oven. We took a grid to carry the "fids" of blubber and asbestos wicks, but they were unnecessary; the ashes from the burnt skin or bits of bone acted as a suitable burning surface. We never needed to "render" the blubber, but just fed it in its native state. This stove must be completely sheltered from strong winds, and we built a granite hut for its use. It cannot be used in the tent, for in spite of all precautions it evolves the filthiest oily soot that ever disfigured scientific note-books.

Note-Books.—Plain good paper with linen-covered cardboard backs, opening sideways, with a loop and pencil and rubber tied on with string. Take four thin books (8 × 5 or so) rather than one thick one.

For long panoramic sketches, fold down one inch of the right-hand page and sketch over this fold, then the panorama can be sketched continuously and to scale on the next pair of pages, and so on.

An ordinary geological hammer of medium weight, a small cold chisel (wrapped in canvas to prevent it sticking to you), and a stout ruck-sack are essential.

Instruments.—The prismatic compass is almost useless for accurate work in the magnetic area. Wright and I used two independently, and found we differed about three or four degrees. This would not perhaps matter for a very small area. The needle is extremely sluggish; but we found them useful for route marching with thick snow falling, and one should certainly be taken.

The plane-table is the instrument *par excellence*. Debenham deserves great credit for taking one south, for Captain Scott was extremely sceptical as to their value on sledge journeys. In open country with a prominent peak (as a referring object) in the line of traverse—conditions such as one always gets in coastal work—the plane-table was extremely rapid and enabled Debenham to do excellent work

each day. For details of the geology of a cape or cliff area the plane-table is simply magnificent.

A light theodolite (4-inch) was carried, of course, to tie on to prominent distant peaks and for elevation and base-line measurements. Latitude and longitude and sun azimuths were taken as checks on the triangulation, which later in our journeys was tied on to Mount Erebus.

Cameras.—We had large experience with these, Debenham taking Ponting's place when the latter returned. We carried Zeiss and Goerz panorama-stereoscope cameras. They had two grave faults for southern work. The rubber focal plane shutters froze stiff, and used to crawl down and then stop halfway, when one wished to give $\frac{1}{50}$ of a second!

Secondly, they were arranged for glass plates. In spite of advice given me by Mawson and other photographers in the South, I am convinced that a hundred films would give one ten times as many good photos as *ten plates*, for plates get scratched and broken, and the weight (the only important factor) is the same. When we went a long side-tramp we always relied on the two *film* cameras, and they succeeded in producing many splendid photos, while the trouble of changing plates at −20° F. (with your head inside a moulting fur sleeping-bag) can be imagined by any one. For geologists I would recommend the Goerz outfit with *front shutters* and a film-pack attachment. As it was, my exposures in a very expensive camera of this type (guaranteed to give $\frac{1}{1500}$ of a second) were made by means of a red cotton handkerchief presented to me by Charles Wright!

For physiographic details, a stereoscopic camera is *sine qua non*; for topographic work a panorama camera is essential; for lantern slides a $\frac{1}{4}$ plate is advisable. The two cameras I have specified fulfil all these conditions, and both have, of course, magnificent lenses.

Clothing.—No one altered the regulation rig very materially. The geologists had to wear the strong corduroy trousers, which were hot for sledging, because the rocks tore wind-proof to pieces. As it was, mine were darned in fifty places with strong twine, and even so were disintegrating when we were picked up. I did not carry my note-books in a case as Wilson preferred, for they slipped easily into the huge pockets on the Wolsey knitted jacket. Aesthetics are perhaps out of place when sledging, but some grey or brown colour would have been an improvement on the white of these otherwise excellent jackets. The white jackets soon gave us an even more filthy appearance than necessary, and one sees too much snow and ice to appreciate white clothing. A neutral colour would really have been a welcome object in the view when sledging over the Barrier.

Boots were, however, the one article in which the expedition was weak. We had all sorts of ski-boots made of fine supple leather, but nothing shod with nails to resist the granite moraines of the western area. When damp, the nails which we inserted soon pulled

out of the soft leather. Real workmen's Bluchers—size 12 to accommodate four pairs of socks—are advisable. The uppers might be made less stiff; but one's legs are swathed in putties, so that matters little. Perhaps professional Alpine boots of the right size might suffice; but plenty of spare spikes and nails should be taken.

Socks.—We took spare socks in our personal gear, but on the first journey, owing to bad boots, we were always darning. On the second I reinforced the heels of my outer socks with an oval patch of canvas (about three inches long), and I never had to darn a pair.

These trivialities bulk extremely large on a sledging trip, so that I make no apology for mentioning them.

Crampons are illustrated in "Scott's Last Expedition." The canvas tops acted admirably over the fur "finnesko." I should prefer the steel spikes to be even longer, and I should think they might be screwed into the aluminium sole so that new spikes could be inserted. They did not make the feet cold to any marked degree.

For use with the leather boots I liked the 1902 type of *Steigeisen*. These were strapped under the instep, and enabled me to walk with great ease on slippery glacier ice, though some of the men found they hurt the feet considerably, and so preferred to risk numerous tumbles.

Food.—The regular ration of pemmican, biscuit and butter was grand, and suited all our party. Chocolate, some flour for "thickers," sugar, tea and cocoa cannot be surpassed as the less important staples. I should be inclined to issue a regular ration of simple condiments or flavourings, especially if the party is going to live largely on seal meat. Onion powder was worth its weight in gold, for we became very tired of seal meat after several months. The latter is practically tasteless (if it is not fishy!), but with onion powder, one did not need a strong imagination to conjure up "steak and onions." The meal is often the only comfort when sledging, and these condiments weigh so little that I think they might be issued.

The Primus and cookers worked very well indeed. We had no trouble in six months, part of which consisted of extremely rough glacier work, which was calculated to jolt to pieces the anatomy of anything less staunchly built than a Hjorth primus.

INDEX.

Adare, Cape, Borchgrevinck's winter quarters, 79; Campbell's party at, 439
Air, ionization of registered, 279
Alcove Camp, described, 133–134; Evans' "whisker stones," 137; return to, 145
Algæ deposits, 136, 155, 296
Alph Avenue, 173
Alph River, 170, 172, 173
Alps, glacial erosion in, 8, 9
Amphipods, 360
Amundsen, chances discussed, 432–433; news of his success, 434; Gran's prophecy, 434–435; charts of his and Scott's parties, 439, 441
Anchor, ice, 60; method of fixing (sketch), 421
"Ancient cups" (sketch), 256
Anemometer, described, 220, 222 (sketch), 306
Antarctica, attraction of, 14; ice erosion in, 14; map showing recent expeditions, 37; charts of recent and future exploration, 450; personnel of coastal parties, 451; notes on outfit, 452 *seq.*
Anton, ignorance of English, 107; accompanies Granite Harbour expedition, 332, 336, 339
Appetite when sledging, 124
Aptera, 381
Arch berg (sketch), 227; photographed, 250
Archeocyathinæ, 256, 303; Wright's discovery of, 441
Arguments, in hut, 273–274
Armadillo Camp, 163
Armitage, Cape, *Discovery* hut at, 189, visited, 202–203
Arthropod, found, 303
Astronomy for travellers, 50–52
Atkinson, Dr. E. L., 4, 133; his blubber stove, 63; excavates *Discovery* hut, 189; institutes physical measurements, 225; successes with fish-trap, 240 241; tests for scurvy, 245; lecture on, 292–293; meteor seen, 247; lost in blizzard, 275 *seq.*; (sketch), 276; landed at Hut Point, 422
Augites, on Observation Hill, 204; at Flat Iron Rocks, 379
Aurora Australis, first seen, 203; watch instituted, 226; observation of, 231–232
Australian harbours, geology of, 23; maps, 24
Avalanche Bay, 352

Balleny Isles, 427
Balloon Meteorograph, described, 234; (sketch), *ib.*; results obtained, 425
Barne, Cape, 85
Barne Glacier, cliff-like edge of, 88; first crossing, 103 *seq.*; features of, 220; movement noted, 322–323
Barrier, first sighted, 81; height of, 82
Barrier shudder, 151, 313
Bath, on board *Terra Nova*, 45; hot, 75, 416
Beacon Sandstone, 131; worm burrows in, 148; not of desert origin, *ib.*; debris, 385
Beardmore Glacier, fossils from, 10, (sketches) 255, 256, 257, 444; Taylor's lecture on, 255; sponge corals from, 256; *Glossopteris* from, 444
Beaufort Island, 85
Beaumont, Sir Lewis, gift of books, 283
Bernacchi, Cape, depôt, 341; minerals found, 341; camp at, 409
Bets, currency used, 163, 369
Bicycling, in Alps in winter, 4; in Antarctica, 315, 316
Biological station at South Bay, 262
Bird, Mt., 334
Birds, catching, 55; shooting, 61
Black Sand Beach, rolled pebbles on, 320
Blizzards, signs of, 157; snow in, 158; wind velocity, 251, 279, 293; explorer in (sketch), 263; higher temperatures during, 293, 295, 363 *seq.*; thick drift of, 294; local nature of, 319
"Blizzometer," 220, 222
Blubber, as food, 158, 176, 455; fork for (sketch), 176
Blubber-lamp (sketch), 201
Blubber-stove, Dr. Atkinson's, 63; in *Discovery* hut (sketch), 193; at Cape Geology, 358; difficulties of, 403; value of, 453

Blue Glacier, snout examined, 153; surroundings of, 154; dangerous surface of, 411
Bonney, Lake, 8, 134, 136, 139, 145
Bonney, Professor, 8, 134
Bonney Riegel, 134, 136
Books, discussed, 50; stock of, in hut, 282
Boots, damaged, 117, 128, 153; sketch of worn, 154; "browning" the, *ib.*; sealskin "brogans" for (sketch), 159; cause sore heel, 169; method of cobbling; 253; Oates' hobnails, 309; crampons for, 322-323; thawed, 333; "ironclads," 373; (sketch), *ib.*; best type for Antarctica, 455
Borchgrevinck, winter at Cape Adare, 79
Botany Bay, 371
Bowers, Lieut. H. R., first meeting with, 9; adrift on sea-ice, 197-198; as geologist, 199; lectures by, 250, 300; Christmas tree, 268 *seq.*; Cape Crozier expedition, 270, 285 *seq.*; Polar books read, 283; provisions bagged, 294; list of stores for Granite Harbour expedition, 332
Breadmaker, Clissold's electrical (sketch), 216
Bruce, Lieut. Wilfrid, 76
Buckle Island, 427
Burdens, various methods of carrying, 138
Butter Point, name and description, 117; depôt, 120; ice breaks up, 152; Taylor's camp at, 338; depôt damaged by weather, 410

CAMERA, "mousetrap," 121, 289; (sketch), *ib.*, 296; damaged by sun, 377. *See also under* Photography
Campbell, V. L. A., independent command of, 6; stores for Eastern Party, 66; attempted relief of, 421, 423; winter at Evans Coves, 442
Castle Rock, composition of, 186; described, 206
Cathedral Rocks, appearance of, 127; depôt at, 150
Catspaw Glacier, 132
Cavendish Icefalls, 148-149
Cephalodiscus, 418
"Chad," Lake, 145
Chanties, 48
Charcot, Dr., 264, 451
Cheetham, 75
Cherry-Garrard, A., gifts to comrades, 13; penguin skinning, 66; adrift on sea-ice, 197-198; editor of *South Polar Times*, 231, 233, 265 *seq.*; hut building by, 262; Cape Crozier expedition, 270, 285 *seq.*
Chess, 271, 384, 400
Christchurch, N.Z., Expedition offices at, 23
Christmas on *Terra Nova*, 73-74
Cinematograph, tabular berg recorded, 59; subjects for, 89; football played for, 321
Cleveland Glacier, 384
Clissold, T., his electrical breadmaker (sketch), 216; fall from iceberg, 316
Clothing, Antarctic, 6; on *Terra Nova*, 36-37; windproof, 120; Wilson's nose-guard, 262; Bowers' lecture on 300 *seq.*; Taylor's notes on, 454. *See also under* Boots, Socks, Goggles
Clove hitch, with one hand (sketch), 163
Coal, loading of, 39-40; found in Antarctica, 388, 392
"Cold Feet" stalactites, 287
Commonwealth Glacier, 143
Cook, Mt., and the Matterhorn, 25 *seq.*
Cook, his duties on sledge journey, 121; methods, 350-351
Copepods, in Polar seas, 74
Copper pyrites found, 309
Coral, sponge, from Beardmore Glacier (sketch), 256
Coral-reef surface, 121, 128
Corethron, staining of floes by, 74
Corner Camp, Evans' journey to, 193
Course, the, 233
Crater Heights, origin of moraines on, 197
Crampons, 322-323, 455
Crevasses, 152, 353, 375, 406
Crow's nest, 35-36
Crozier, Cape, desired as headquarters, 80; visited by boat, 83; midwinter expedition to, 271-272, 285 *seq.*
Cuff Cape, 376
Current meter, 68
Cwms (armchair valleys), 127; formation of, 136; on Davis Glacier, 161; on Mt. Lister, 167, 340; theory of, 174 *seq.*; diagrams, 175
Cycle of life in Polar seas, 74-75, 83-84; rhyme, 84

DAILEY Island, 177, 178
Danger Slope, 113, 186
David, Professor F. W. E., work under, 7; advice by, 10; letter by, found, 105; 120, 142, 257, 346, 416, 445
Davis Bay, 158
Davis Glacier, 161; (sketch), *ib.*

Davis, Professor W. M., 8, 160
Day, B. C., 9, 66, 85; binding for *South Polar Times*, 254, 265; lecture on motor sledges, 264; ingenious turning, 307; difficulties with motor sledges, 322 *seq.*; dangerous journey of, 440–441
Debenham, Frank, 11, 66; visits Inaccessible Island, 95; geological and photographic work, 119; black lava found, 134; as cook, 176, 350; frost-bitten, 179; painting, 248; collection of sixpenny novels, 283; Cape Evans mapped, 295; long distance geology, 307; Tent Island explored, 311, 316; trip to Shackleton's hut, 319 *seq.*; knee strained, 321; excellent sight of, 369; coal found, 388; value of plane-table, 453
Debris cones, 296, 297, 385
Demetri, 91
Dennistoun, Mr. J., 416, 424
Descent Pass, 127, 130, 151
Devil's Punch Bowl, and Thumb, sketch map of region, 376: features of, 378
Dewdrop Glacier, 378
Diatoms, 74
Discovery, pack crossed, 78
Discovery Bluff, 371
Discovery Hut, condition of, 106; compared with Shackleton's hut, 113; described, 189 *seq.*; environs of (sketch), 190; plan of (sketch), 191; difficult approach to, 192; blubber stove at (sketch), 193; routine at, 194; literature at, 195; storm at, 196; sleeping quarters, 198; sunsets at, 199; Scott's visit to, 216, 223. *See also under* Hut Point
Distances deceptive, 150
Dogs, Antarctic born, recognise water, 10; put on board *Terra Nova*, 30; hangar for on ship, 46; character of, 52, 281, 290; exercised on floes, 69; and penguins, 69, 88, 91; and seals, 116, 332; "rifle pits" for, at Hut Point, 193; "Macaca" found, 260; puppies born, 290
Dog-sledging, 91; Scott, 106; Taylor, 115
Dog-teams, Peary's use of, 9; guided by voice, 69, 91, 116
Dolerite sills, 131
Double-Curtain Glacier, 125–126
Drake, F. R. H., 66, 428
Dry Valley, 9, 130, 132, 142 *seq.*; Lt. Evans' chart of, 280
Dun Glacier, 131
Dunlop Island, minerals found on, 309; features of, 344

EARTH, shape deduced, 272, 279
England, Mt., 380
Erebus, Mt., compared to Vesuvius, 85; appearance of steam cloud on, 88, 218, 281 (sketch), *ib.*, 295, 325, 346; crevasses on, 189; signs of heat from, 217; activity of, 288
Erosion: frost, 380: glacial, study of in Alps, 8–9, 14; problem in Antarctica, 14–15; in New Zealand Alps, 23–29, 120, 132; stages of, 133; wind action, 134, 145; on Taylor Glacier, 136; no lateral in Antarctica, 148; on Mackay Glacier, 377: water, 138, 159; at Tent Island, 311
Erratic (sketch), 387
Euchre, 302
Euphausia, 63, 65, 75
Evans, Cape, named, 86; site described, 87, 215; sketch of, 90; landing at, 89 *seq.*; lakes at, 87, 215; plan of hut at, 212; music at, 223; magnetic variation at, 261; pull of gravity at, 279; physiographic features of, 298 *seq.*; map of, 299; ice-forms at, 310–311; *Terra Nova's* return to, 418
Evans Coves, 439, 441
Evans, Lieut. E. R. G. R., 6, 9; journey to Corner Camp, 193; chart of Dry Valley, 280; coast survey by, 295; trip to first depôts, 313; attacked by scurvy, 421, 442
Evans, Edgar, P.O., 5, 137; "Football Fields" named, 139; straw hat, 145; a fall, 148; former expedition, 151; and literature, 151, 284, 302; on Blue Glacier, 153; humour of, 153, 157; one-handed clove hitch, 163; as steersman, 165; loses a bet, 171; imaginary frostbite, 182; on blizzards, 185; prudence of, on Danger Slope, 186; lessons in cobbling given, 253, (sketch), *ib.*; as bezique player, 259
Eyes, effect of Antarctica on, 49

FELSPAR, from Erebus, sketch of, 145
Fern, sketch of fossil, from Beardmore Glacier, 444
Ferrar Glacier, former accident on, 75; explored, 121–131; surface altered since 1902..129; movement of, 151, 202, 309; shape of ice at mouth of, 257–258; Scott's trip to, 304, 309
Ferrar, Mr. H. T., on ice slabs, 162
First View Point, 349

"First Western Expedition," 113 *seq.*
Fish, caught by floe, 70; *Notothenia*, 97; in ice, 180, 202; remains of, on glacier, 164, 165; trap for, 240–241; parasites in *Notothenia*, 241; caught, 251; fossils of, found, 386
Flagellata, at Cape Evans, 215
Flat Iron, 377; unusual minerals on, 379; survey of, and composition, 392
Flea, primitive, 125
Food, biscuit packing, 119; allowance on sledge journeys, 335; cooking of, 350–351; suggestions for, 455
Football in Antarctica, 236, 238, 247; for cinematograph, 321
"Football Fields," 139
Forde, R., P.O., attacked by gangrene, 313, 331; cave discovered, 352; reservoir constructed, 354, (sketch), *ib.*; as seal butcher, 355; as cook, 360; and literature, 363; snow-blindness, 408
Foraminifera (*Orbulina*), 68, 74
Fossils, from Beardmore Glacier, 10, 255 *seq.*; sketches of, 255–257; on Gondola Ridge, 386
Frostbite, pain of, 116; Taylor's toe, 202; Forde's hand, 313, 331

GAMES in Antarctica, 271. *See also* Football, Euchre, Chess
Geology, Cape, blubber-stove at, 358; view from (sketch), 374
George, Lake, rain gauge in, 240
Glacial erosion. *See* Erosion
Glacier Tongue, nature of, 113; bulbous icicles on, 117; sea-ice broken away from, 189; broken fragments from, 309, 342; features of, 315; waved edge of (sketch), 316
Glaciers, of New Zealand visited, 25 *seq.*; map, 27; of Antarctica, organic remains on, 127, 177; tables, 132; twin, 130, 149; in Luzern valley (sketch), *ib.*; movement measured, 151, 202, 309
Glasson, 7
Glenroy, parallel roads of, 160, 296
Globigerina *ooze*, 75
Glossopteris from Beardmore Glacier (sketch), 444
Gneiss Point, 342
Goggles, fogging of, 335; benefit of amber glasses, 369
Gold, washing for, 145
"Golden Stairs," 233
Gomphocephalus, found at Granite Harbour, 356 (sketch), *ib.*; Lillie's catch of, 418
Gondola Ridge, 384; fish fossils on, 386; sketch of, 391
Gramophone records, at Cape Evans, 265
Gran, Lieut. Tryggve, former experiences, 13; as ski expert, 68, 69; and white magic, 76; ice caves discovered, 230; guesses at *South Polar Times* authors, 278; debris cones dissected, 297; ski slope constructed, 312; birthday present to Taylor, 357; as cook, 357; latitude and longitude, simple method of calculating, 357; sea-kale planted, 370; golden mica found, 377; midsummer bathe in open air, 378; as surgeon, 379; Mt. Suess circumnavigated, 388; birthday ode, 401; prophecy of Amundsen's success, 434–435
Granite, on Dunlop Island, 309
Granite Harbour, expedition to 321, 331 *seq.*; Bowers' list of stores for 332; reached, 348; seals at, 353; pressure ridges in sea-ice (sketch), 361
Gravity, pull of, at Cape Evans, 279
Grummets, 409
Gully Bay, algæ deposits above, 296

HAIR clipping, 38
Harbours, Australian, geology of, 23; maps, 24
Hat, straw, 146
Heald Island, 167–169
Hedley Glacier, 131
Hjort's Hill, 409
Hobbs Glacier, 158–159
Hooker Glacier, 281
Horses, Oates' lectures on, 246–247. *See also under* Ponies
Hut, building of, 98 *seq.*; map of locality, 107; life at, *ib.*; interior arrangement of, 108
Hut Point, geological sketch of, 114–115; arrival at, 186; seals killed at, 192; wind at, 196; difficult approach to, 192; telephone to, 319. *See also under Discovery* Hut.

ICE, pack: met, 58; scene in, 60; width of, 76, 78; pressure blocks, 77; map of course through, 77
Ice problems, Wright's lecture on, 248
Ice-age, future (sketch), 281
Ice-anchor, 60; method of fixing (sketch), 421
Icebergs: the first, 56; origin of various kinds, 56, 59; watch for, 57, 64, 75, 427; effect of wind on, 59; sketches

of, 64; a white-back, 70, 71; Tunnel berg, 96, (sketch), 97; mistaken for islands, 345; various shapes of, 347; flexure of (sketch), 403
Ice-forms: pancake, 58, 60, 77; sun-holes, 93 (sketch), *ib.*, 121; coral-reef surface, 121, 128; topsy-turvy icicles, 124; fan crystals, 124, 128; arabesques, 126, 132, 291; ploughshare, 128, 148, 162; thumb marks, 148; icefalls, 148, 149; slabs, 155, 162; bottle-glass, 156, 384; glasshouse, 156, 157, 162, 384; various, 163; armadillo, 163; frozen park, 164; honeycomb, 165; Stonehenge, 168; stalactites, 170; caves formed by crevasses, 230; at Cape Evans, 310–311; crystals, 288–289; screw-pack, 338–339
Ice-houses, 101, (sketch), 102
Inaccessible Island, visited, 95, 287; direction of blizzards on, 294; wind-ridge on (sketch), 294
Infusoria, 74
Instruments, value of various, 453–454
Invertebrates, Nelson's lecture on, 303
Ionization of the air, registered, 279
Island Lake, 233

"JAM-JAR," 128
Jeannette, 283

KAR Plateau, 365; granite cliffs (sketch), 375
Kea Point, 28
Keerweer Camp, 179
Kenyte, 87; felspar in, 145; on Land's End moraine, 291; at Cape Bernacchi, 309
Killer-whales, attacks on men, 75, 95, 152; on ponies, 198
Knob Head Mountain, features of, 149; magnetic variation at, 261
Koettlitz Glacier, moraine deposit from, 160; explored, 167–173; stream from, 168
Kukri Hills, 127; coaly debris, 134; Wales Glacier named, 143; age of rocks, 146–147; cwm valleys on, 340; camp below, 409

LACROIX Glacier, 140, (sketch), *ib.*, 162
Lakes, at Cape Evans, 87; *Flagellata* in, 215
Land's End, features of, 230; named, 233
Lashley, W., former experiences, 75; Polar journey, 442
Lateral moats. *See* Moats
Latitude and longitude, simple method of calculating, 357
Lectures, list of winter, 229
Levick, Dr. G. M., 49; and seal killing, 120; penguin studies, 439
Lichens, at Cape Geology, 360, 387
Lillie, D. G., former adventures, 7; caricatures by, 65; collections made, 418
Lister, Mt., 127
Literature, on sledge journeys, 151. *See also under* Books
Lots, novel method of drawing, 357
Luzern, Lake, formed by twin glaciers, 130, 149
Lyons, Capt. H. G., 447
Lyttelton, reached, 11, 21; geology of, 23; experiences at, 23; return to, 435

MACKAY Glacier, 348, 353; ice-tongue, 359, 365; tongue movement measured, 373, 375, 395; erosion on, 377; journey over, 382 *seq.*
Mackellar, Mr., gift of books, 283
McMurdo Sound, 85
Magic, white, 76
Magnetic needle, dip calculated, 261
Magnetic variation. *See* Variation
Marble Cape, 342
Marine animals in sea ice, 177
Markham, Sir Clements, gift of books, 283
Marr, Dr., 3
Matterhorn, 25 *seq.*; the Antarctic, 25; described, 145
Mawson, Dr., 5, 7, 9
Meares, C. H., dogs and ponies collected, 11; and dog sledges, 69; penguin-charmer, 72; return from Hut Point, 245; Barrier journey, 440–441
Melbourne, Mt., 418
Meteorograph, balloon. *See* Balloon
Meteorology, Simpson's lecture on, 288; station routine, 305
Mica, golden, found, 377
Microscopic life, 74
Midnight sun. *See* Sun
Midwinter Day celebrations, 264 *seq.*
Mill, Hugh Robert, 451
Mirabilite, 155; evidence of upheaval, *ib.*
Moats, lateral, 126, 134, 147, 377; measured, 147–148
Monteagle, Mt., 79
Moraines, medial, 146, 387; silt, 155, 156; crater lakes in, 156; on Crater Heights, origin of, 197; Gondola Ridge, 386–387; "road metal," 410;

Strand, 410; Archæocyathine fossil in, 441
Morning, voyage of, 58; pack crossed, 78
Morse Code, keywords, 35
Mosses, at Cape Geology, 360, 393
Motor-sledges. *See under* Sledges
Mueller Glacier, 28
Murchison Glacier, 26
Music, on *Terra Nova*, 48; at Cape Evans, 223, 254

NANSEN, Mt., 418
Natrolite, found, 379
Nelson, E. W., 7; tow-net captures, 65; soundings at Cape Evans, 249; biological station, 262; "star performer" at games of skill, 271; propensity to argument, 273; sounding tackle frozen in, 293; lecture on invertebrates, 303; accompanies Granite Harbour expedition, 332, 336, 339
New Glacier, 377; erosion on, 380–381
New Harbour, crossed, 340; signs of 1902 expedition, 409
New Year's Day on *Terra Nova*, 79
New Zealand Alps, ice conditions in, 23–29
Nicknames of the officers, 213
Nimrod, 21
North Bay, 233
Notothenia, in ice, 97, 180, 202, 203; eye lens, 98; parasites in, 241
"Nursery," the, 46, 66
Nussbaum, Dr., 9
Nussbaum, Mt., 143

OATES, Capt. L. E. G., 13, 66; sack-cloth helmet (sketch), 200; bunk built by, 227; lectures on horses, 246–247; taste in literature, 283, 284; departure on Southern Journey, 326
Observation Hill, telephone to, 101; Scott's cross on, 113; augite crystals on, 204
Ocean soundings. *See* Soundings
Officers, travels of, 242, maps, 12; list of, 15 *seq.*; nicknames of, 213; musical abilities, 223; physical measurements of, 225, 248; occupations in the hut, 248–249; list of returning, 424; presented to King George, 446
Orca gladiator. *See* Killer-whales
Organic remains on glacier, 127
Overflow Glacier, 127, 128

PACK ice. *See under* Ice
"Paddock," the, 233
Palimpsest theory of glacial valleys, 174 *seq.*; diagrams, 175
Parasites in *Notothenia*, 241
Park Lane Camp, 164
Parties, list of, 15 *seq.*
Paton, 75, 85
Peary, Commander, lecture by, 9
Pendulums, ice grotto for, 278–279; show pull of gravity, 279
Penguins: Adélie, first seen, tricks of, 64: Emperor, first seen, 71; contents of stomach, 71; frozen in, 82; on Ferrar Glacier, 127–128; hardness of bones, 128; swimming, 154; at Cape Crozier, 271, 286; eggs examined, 325: hunting on floes, 72; appearance of swimming, 85; spoor of (sketch), 94; Wilson's lecture on, 244–245
Pennell, Lieut. H. L. L. 34, 66, 76, 423
Perched Block (sketch), 387
Pets on *Terra Nova*, 53, 428
Photography, in field work, 119; Taylor's outfit, 224; Antarctic, 224, 452. *See also under* Camera
Physical measurements of officers, 225, 248
Piedmont Glacier, 152 *seq.*, 342, 345, 405
Ponies, landing of, 89; "Hackenschmidt," 89, 100; "Blucher," 101; "Guts," 101; "Weary Willy," 101; lost on sea-ice, 197–198; Oates' lectures on, 246–247; verminous, 278; arrangement of on Southern Journey 325
Ponting, H. G., 11, 70; and killer-whales, 95; and Tunnel berg, 96; work at Cape Evans, 214, 215, 250; lecture on Burmah, 242; cinematograph films exhibited, 282; lantern slides exhibited, 295; coaches Scott and Bowers in photography, 304; successful studies obtained, 440
Port Chalmers, 35
Potholes, 282, 383
Pram (Norwegian dinghy), 61, 62, 72
Pram Point, 202
Prestrud (Amundsen's lieutenant), 440
Priestley, R. E., 10, 85; old footprints of, found, 286; ice notes, 439
Pulpit Rock (sketch), 370
Pumps, choked in storm, 42; plan of, *ib.*

QUARTZ found, 309
"Quick runs," in magnetic work, 261

RAMP, the, named, 233; origin of debris cones on, 296; cones dissected, 297, (sketch), *ib.*; composition of, 298

Range-finder for icebergs, 46, 57
Referring Facet, 384
Rennick, Lieut. H. E. de P., 4, 34, 66, 76
Riegels, 134, 136, 141, 143
Roberts, Cape, features of, 399; camp at, 400 *seq.*; depôt left at, 406
Rocks, age of (sketch), 147; sedimentary, near Taylor Glacier, 141; solitary, 132–133, 147
Ross Island, sketch-map, 81; survey of, 85; *Discovery* hut on, 189
Round Valley, 144–145
Royal Society Range, 127
Royds, Cape, Shackleton's hut at, 105–106; Taylor's visit to, 260

SABINE, Mt., 79
Sails, Bay of, 343
Salmon Peak, 160
Schizopods, 75
Science men as seamen, 35, 424
Scotia, 46
Scott, Captain R. F., 4; first impressions of, 5; old adventure on Ferrar Glacier, 75; visits Hut Point, 106; geological sketch of Hut Point, 114; facsimile of sledging orders, 122–123; One Ton depôt laid, 189; variety of interests, 196; journey to Cape Evans, 207 *seq.*; takes party to *Discovery* hut, 216, 223; Sunday services at Cape Evans, 225; institutes aurora watch, 226; main features of winter quarters named, 233; lecture on Plans of the Expedition, 241–242; belief in discussions, 248; discussion on Ferrar Glacier, 257–258; speech at Midwinter Day dinner, 268; Taylor Glacier named, 280; taste in literature, 283, 325; trip to Ferrar Glacier, 304, 309; Taylor's summer plans discussed, 311; Taylor's sledging orders, 321; departure on Southern Journey, 325; charts of his and Amundsen's parties, 439, 441, 442; hardest day's work, 440; reason of disaster to, 443–444
Scurvy, Atkinson's tests for, 245; his lecture on, 292–293; Lt. Evans attacked by, 421, 442
Sea, winter temperature of, 262
Seal Rock, 233
Seals, crab-eater, 62–63, 65; flensing, 63, 358; killing, first experiences, 116, 120; twenty miles up glacier, 141, 167–168; lassoed, 155; killed at Hut Point, 192, 196; method of enlarging ice-holes, 317, (sketch), *ib.*; and dogs, 116, 332; at Gneiss Point, 342; at Granite Harbour, 353; method of butchering, 355; meat as substitute for pemmican, 360
Sedimentary Rocks. *See* Rocks
Seward, Professor, 3, 444
Shell, found on Ferrar Glacier, 125
Simpson, Dr. G. C., 5, 13, 66; meteorological instruments, 221; balloons sent up, 234 (sketch), *ib.*; lectures by, 236, 288; magnetic work, 261; return of sun first seen, 295; value of weather records, 440
Siphonophora, 262
Sketching, Wilson's lecture on, 251–253; value of, in Antarctica, 452; notebooks for, 453
Ski, 68, 293
Ski-ing, learning on the floes, 69; on Erebus slopes, 103
Skua gulls, mode of killing, 11, 100; young learning to fly, 179; quarrelsome nature of, 355, 399; eggs obtained, 372, 378; sketch of embryo, 373; signs of intellect in, 380
Skua Lake, 233
Sledge diary, 181 *seq.*
Sledge-flags, 49, 73
Sledge foods, Bowers' lecture on, 250
Sledges, loads of, on First Journey, 117–119; steel runners for, 119, 452; motor, 91; loss of, 99 *seq.*; Day's lecture on, 264; difficulties with, 322 *seq.*
Sledging, stores, how calculated, 53; weights carried, 54; literature carried, 151; facsimile of orders, 122–123; food allowance, 335; cooking, 350–351
Slippery Slope, 233, 296
Smith, Mr. Reginald J., gift of books, 50, 283
Snow, as thirst quencher, 373
Snow-blindness, 408
Snow Valley, 116, 169, 173
Socks, patent heel-tip (sketch), 308, 455
Soil-creep (solifluxion), 115, 300, 388
Sollas Glacier, 139, 162
Solitary Rocks. *See* Rocks
Soundings, depth of ocean, 61, 79; apparatus (sketch), 67; off glacier mouths, 120; off Cape Evans, 249
South American Glacier, 131
South Bay, named, 233; biological station at, 262
South Polar Times, Wilson's sketches, 156; resumed, 231; Day's binding for, 254; volumes produced, 265 *seq.*, 302–303, 317; guesses at authors, 270, 303
Spiders, sea-, 303
"Sponge-coral" (sketch), 256

Sponges, in the ice, 177, 180
Springtail, Antarctic. *See Gomphocephalus*
Stalactites, how formed, 287
Stamps, surcharged, 80
Steig-eisen (sketch), 197
Stocking Glacier, 28, 132
Storm, on outward voyage, 40–44; on homeward voyage, 428–432
Strand moraines, 410
Straw hat, 146
Suess Glacier, and sketch, 141–142
Suess, Mt., 362; nunatak (sketch), 383; map, 385; circumnavigated, 388, (sketch), 389
Sun, midnight, 59; lowest point of, calculated, 269, (sketch), *ib.*; return of, celebrated, 294; first seen, 295
Sunholes, 93, 121
Sunshine recorder, sketch of, 306
Swinging ship. *See Terra Nova*

Tasman Glacier, 26; sketch of, 27
Taylor, Griffith: official position, 7; a walker, 7, 10; visit to Alps, 8, 9; survey work in Australia, 10; his problem in Antarctica, 14; bowie-knife disturbs compass, 34; midnight watch, 59; retrieves fish from floe, 70; sledge work on landing, 92; visits Inaccessible Island, 95

First Western Journey, 111 *seq.*; a geologist's equipment, 144; washes for gold, 145; fall into "moat," 147; dreams, 150, 182; adventure among crevasses, 152; lassoes a seal, 155; a week's cooking, 165–166; flooded out, 174; unfulfilled prophecy, 177; sledge diary, 181 *seq.*; hallucination, 185

A Month in Discovery Hut, 189 *seq.*; visits Crater Heights, 197; cook, 200, 202; dreams, 201; frostbite, 202; fall into sea-ice, 205; journey to Cape Evans, 207 *seq.*

In Winter Quarters, 211 *seq.*; plan of hut, 212; first aurora seen, 218; report on Western Journey, 219; musical abilities, 223; photography, 224, 296; ice caves visited, 230; night watchman, 231, 243, 264; main features of winter quarters named, 233; lectures by—on principles of physiography, 238–239; on Beardmore Glacier, 255; on physiography of Western Mountains, 270; on glaciation, 295; on corals, 303; list of officers' travels, 242–243; physical measurements, 225, 248; articles for *South Polar Times*, 241, 243, 287, 288, 312, 318; hut routine, 247–249; chart of mean temperatures, 255; visit to Cape Royds, 260; speech at Midwinter Day dinner, 268; sun's lowest point calculated, 269; competition with Gran, 270; chess, 271; hut arguments, 273–274; dreams, 277–278, 287; night watch supper (sketch), 274; "jam day," 279; Taylor Glacier named, 280; Erebus steam cloud sketched, 281; books read, 283–284; book-binding, 293; Cape Evans mapped, 295, 298 *seq.*; plane-table improvised, 295; debris cones dissected, 297; Wilson's caricature of, 301; meteorological work undertaken, 303, 305; "patent heel-tips," 308; Tent Island visited, 311, 317; summer plans discussed with Scott, 311; bicycling to Turk's Head, 314–315; trip to Shackleton's hut, 319 *seq.*; sledging orders for Granite Harbour expedition, 321; Barne Glacier traversed, 322–323; last impressions of Oates and Wilson, 326–327

Granite Harbour Expedition, 329 *seq.*; sledges packed, 331; Bowers' list of stores, 332; blizzards met, 333, 335, 362 *seq.*; magnetic variation, 337; steering on the march, 337; Butter Point reached, 338; relaying, 339; survey, 340; ice-yacht, 342–343; dreams, 342, 364; night marching, 345; Granite Harbour reached, 348; View Point camp, 349; foods on sledge journey, 350–351; cave discovered, 352; cloud effects, 353; water supply, 354; seal hoosh, 355; *Gomphocephalus* found, 356; birthday of, 356; adventures on sea-ice, 366; benefit of goggles, 369; finger cut, 371, 376, 379; snow as thirst-quencher, 373; value of "ironclad" boots, 373; Mackay Tongue movement measured 373, 375; unusual minerals found, 379; Christmas Day celebrations, 380; insects embalmed, 381; journey over Mackay Glacier, 382 *seq.*; peaks and glaciers named, 384; fish fossils found, 386; Mt. Suess circumnavigated, 388; Mackay Glacier movement measured, 395; return journey begun, 396; fall into sea, 397; as "sledge poet," 398, 401; Cape Roberts camp, 400 *seq.*; *Terra Nova* seen, 402; crevasses met, 406 *seq.*; snow-blindness, 408; picked up by *Terra Nova*, 411

The Voyage Back, 413 *seq.*; gifts

from home, 415–416; gale off Cape Evans, 418–419; "luff upon luff" (sketch), 420; coal-trimming, 424–425, 433; cables for Associated Press prepared and despatched, 427, 433; "iceberg watch," 427, 428; record gale, 428–432; sperm whales seen, 433; Akaroa reached, 434
THE END OF THE EXPEDITION, 437 *seq.*; *résumé* of journeys of other parties, 439 *seq.*; books sent to remaining members of Expedition, 445; presented to King George, 446; allocation of funds, 446
APPENDIX, 449 *seq.*; paper published by Royal Geographical Society, 451; lessons of Antarctic experiences, 451 *seq.*
Taylor Glacier, 132–138; sketch of moraine on, 135; wind action on, 136; crater near, 136, (sketch), 137; previous visit to, 139; and valley, 141; named by Scott, 150, 280
Telephones, 101, 103, 294, 315, 319, 326
Temperature, of sea in winter, 262; of hut, 263, (sketch), *ib.*; high during blizzards, 293, 295, 363 *seq.*; snow melted, 305; heat of solar rays, 345
Tent, advantage of wider floorcloth for, 333, 452
Tent Island, 286; features of, 311; seals at, 317
Terra Nova, 6, 21; voyage to New Zealand, 11; plans of, 22, 39; leak stopped, 30; arrangement of, 30 *seq.*; swinging ship, 34, 46, 80; storms, 40 *seq.*, 428 *seq.*; dinner on, 46; icing ship, for fresh water, 61, 421, 422; Pennell's notice, 423 *n.*; Christmas on, 73–74; returning officers, 76; sketch of course through pack, 77; landing at Cape Evans, 87 *seq.*; stranded, 108; picks up Taylor's party, 411; return voyage of March, 1912; map, 414; "rocking ship," 417; gale off Cape Evans, 418–419; anchor raised by "luff upon luff" (sketch), 420; coal-trimming, 424–425, 433; Akaroa reached, 434
Terror, Mt., 346
Tesselations, 158, 160
Thermometer screens, erected, 272; names for, *ib.*
Thomson, Alan, 10
Travels of the officers. *See* Officers
Tremolite found, 379
Turk's Head, 113; features of, 314, 315
Twin Glaciers, sketch of, 280

Universitas Antarctica, 228

VARIATION, magnetic, 80, 337; at Cape Evans and Knob Head Mountain, 261
Vegetation, three types found, 125; algæ, 136, 155, 296; mosses, 125, 360, 393; lichens, 360, 387
Vince's Cross, 113
"Virtue Villa," 191

WALCOTT Glacier, 169
Wales Glacier, 143
Ward Glacier, 169, 171–172
Weather, local types of, 426; value of Simpson's records, 440. *See also* Blizzards, Temperature, Wind
Whales, 69, 433. *See also* Killer-whales
Whales, Bay of, chart, 432
"Whisker-stone," 137
Wilson, Dr. E. A., 3, 13, 65, 66; penguin hunting, 72; on tone values, 199; truth of his sketches, 199, 203; lectures by, 235, 244–245, 251–253; sketch of nose-guard, 262; Cape Crozier expedition, 270, 285 *seq.*; caricature of Taylor (sketch), 298; his kindness, 304; "Barrier Silence" poem written, 313; Emperor penguin eggs examined, 325; departure on Southern Journey, 325
Wind, tolerable without snow, 14; at Hut Point, 196; changes in direction (sketch), 217; record velocity, 279; maximum velocity of winter, 293
Windproof clothing. *See* Clothing
Wind Vane Hill, 233
Winter Quarters, main features named, 233
Worm burrows in sandstone, 148
Wright, C. S., 3, 7, 66; work on ice crystals, 119, 134; Kukri Hills visited, 147; judging distances, 150; fall into crevasse, 152; Davis Glacier examined, 161; and seals, 173; journey to Corner Camp, 193; lecture on ice problems, 248; time observations, 272; pendulums, 278–279; ice-section "rubbings," 282; diary entries, 289; *Archæocyathine* fossil found, 441
Wyatt, Mr. G. F., 31

THE END

PRINTED BY WILLIAM CLOWES AND SONS, LIMITED, LONDON AND BECCLES.

00083415

Digitized with financial assistance from
Hermès India
a project facilitated by the Rotary Club of Bombay

on 10 August, 2018